Technical Memorandum

To: Project Files

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Re: **Stability Analysis Memorandum**
Tailings Storage Facilities
Rosemont Copper World Project

Executive Summary

The slope stability factors of safety for the Tailings Storage Facilities (TSFs) for the Rosemont Copper World Project (Project) meet or exceed the acceptance criteria as required by the Arizona Department of Environmental Quality (ADEQ) Best Available Demonstrated Control Technology (BADCT) Guidance Manual (ADEQ, 2004) for both the interim and final configurations. Critical cross sections of the embankment slopes and facility side slopes were modeled using Slide2 (Rocscience, 2021) limit equilibrium software to assess slope stability under static and earthquake conditions (pseudo-static and post-earthquake conditions). The design seismic event with a return period of 10,000 years was selected for pseudo-static stability evaluation of critical sections of the TSFs. Moreover, maximum credible earthquake (MCE) was considered to estimate earthquake-induced permanent slope displacements and evaluate potential impact on the public and human life using an empirical method by Bray and Travasarou (2007).

1.0 Introduction

1.1 Purpose

Wood Environment and Infrastructure Solutions, Inc. (Wood) has prepared this technical memorandum for Rosemont Copper Company (Rosemont) to addresses the stability analyses in support of the Aquifer Protection Permit (APP) Application and Pre-Feasibility Study (PFS) Level Design Phase of the TSFs for the Project in accordance with requirements of ADEQ and Arizona Mining BADCT Guidance Manual (ADEQ, 2004).

The use of BADCT to minimize the impacts to groundwater is required by ADEQ to obtain an APP for the planned new TSFs. BADCT is to be applied throughout the entire facility life cycle including design, construction, operation and closure. Engineering analyses were performed in general accordance with requirements for the APP, Arizona Revised Statute (A.R.S.) 49-243.B.1 and followed the individual BADCT criteria.

The data presented in this technical memorandum addresses the slope stability analyses performed to assess the slope stability of TSFs planned to support a PFS level design for the Project. Both static and pseudo-static analyses were performed using the Slide2 (Rocscience, 2021) computer program to perform limit equilibrium slope stability using the Morgenstern-Price's method (1965) of slices. Moreover, earthquake-induced slope displacements were estimated to evaluate potential impact on the public and human life using an empirical method by Bray and Travasarou (2007) and considering an MCE.

1.2 Background Information

Numerous reports and BADCT demonstrations have been prepared as part of the previous permitting process for the Project studies including the following key studies related to designs of TSFs:

- Geotechnical Study Report, presenting initial geotechnical site investigations conducted in 2006-2007 at the Rosemont Copper Project (Tetra Tech, 2007a).
- An addendum to the 2007 Geotechnical Study Report (Tetra Tech, 2009).
- A detailed engineering and permitting design of a Dry Stack Tailings Storage Facility for the Rosemont Copper Project (AMEC, 2009).
- A summary of additional sampling and testing performed on tailings and waste rock for the Rosemont Copper Project (AMEC, 2010).
- A summary of geochemical and physical characterization tests that were conducted on fourteen (14) tailings samples (AMEC, 2014).
- A summary of geotechnical laboratory testing results of tailings (Knight Piesold, 2015).

Many of the materials used for this study were the same as those used in previous studies. Additionally, Wood has completed geotechnical investigations and laboratory testing in and near the TSFs/Heap Leach Facility (HLF)/Waste Rock Facility (WRF) sites as part of the design process (Wood, 2021). The investigation included field mapping, test pit excavation, borehole advancement, and field and laboratory testing. The previous and new data forms the basis of the TSF designs. In addition to the field and laboratory investigation, samples of potential borrow materials were collected and tested from within the Project area for construction of TSFs.

2.0 BADCT Criteria

2.1 General

The operation of a tailings disposal facility in the State of Arizona requires that the facility be permitted under the promulgated APP program. The construction of the tailings dam requires that a permit be issued by the State of Arizona. The construction and operation of the dam should follow the BADCT for a specific mining facility type and site in accordance with A.R.S 49-243.B.1.

This statute requires all permitted facilities to utilize BADCT in their design, construction and operation while considering various factors depending on whether the facility is new or existing.

The requirements of BADCT are met, according to A.R.S. 49-243.B.1, if it is demonstrated:

> That the facility will be so designed, constructed and operated as to ensure the greatest degree of discharge reduction achievable through application of the best available demonstrated control

technology, processes, operating methods or other alternatives, including, where practicable, a technology permitting no discharge of pollutants. In determining best available demonstrated control technology, processes, operating methods or other alternatives, the director shall take into account site specific hydrologic and geologic characteristics and other environmental factors, the opportunity for water conservation or augmentation and economic impacts of the use of alternative technologies, processes or operating methods on an industry-wide basis. However, a discharge reduction to an aquifer achievable solely by means of site specific characteristics does not, in itself, constitute compliance with this paragraph. In addition, the director shall consider the following factors for existing facilities:

(a) Toxicity, concentrations and quantities of discharge likely to reach an aquifer from various types of control technologies.

(b) The total costs of the application of the technology in relation to the discharge reduction to be achieved from such application.

(c) The age of equipment and facilities involved.

(d) The industrial and control process employed.

(e) The engineering aspects of the application of various types of control techniques.

(f) Process changes.

(g) Non-water quality environmental impacts.

(h) The extent to which water available for beneficial uses will be conserved by a particular type of control technology.

Arizona Administrative Code (A.A.C.) R18-9-A202(A)(5) requires that an application or major modification for an APP include a description of the BADCT to be employed at the facility. The procedures and information presented in this guidance manual are intended for use in determining the appropriate BADCT, and to assist the applicant's development and the ADEQ's review of permit applications.

2.2 Prescriptive and Individual BADCT Permitting

As aforementioned, BADCT should be applied throughout the entire facility life cycle including design, construction, operation and closure. As promulgated, two general approaches to demonstrate BADCT are possible:

Prescriptive BADCT requires evaluating and selecting a pre-determined discharge control technology as the BADCT design. Typically for new precious and base metal tailings facilities, this requires a composite liner consisting of a single geomembrane underlain by a minimum of one (1) foot (ft) of compacted soil with a saturated hydraulic conductivity less than 10^{-8} meters per second (m/s). The geomembrane should be covered by a protective drainage soil layer with a minimum thickness of 1½ foot consisting of a 19 millimeters (mm) minus well-draining material. Additionally, the drainage layer should have corrugated perforated high-density polyethylene (HDPE) pipes of three (3) inches (75 mm) or larger diameter at 20-ft (6 meters) spacing. The drainage layer should flow by gravity to a low point where the fluids can be removed, thereby minimizing the hydraulic head over the liner.

Tailings disposal for base metal mines involves hydraulic deposition of large volumes of tailings slurries and application of prescriptive BADCT may be impractical and cost prohibitive. BADCT recognizes that adequate discharge control has been achieved in un-lined basins employing control techniques that take advantage of the arid and semi-arid climate in Arizona in conjunction with natural geologic controls, including a low permeability foundation, deep water table, special construction materials and a high degree of hydrologic isolation. For these cases, individual BADCT is advocated.

Individual BADCT: establishes a reference design incorporating a combination of demonstrated control technologies which are appropriate for the site and then evaluating the aquifer loading potential for the reference design and alternative designs. The practical design resulting in the lowest significant pollutant load to the aquifer would be selected as the BADCT design. Individual BADCT development may be based on considerations of waste characteristics, site characteristics (hydrology, hydrogeology, etc.), design measures, operational features and closure methodology.

3.0 Tailings Storage Facility Designs

Rosemont plans to construct two new TSFs (herein referred to as TSF-1 and TSF-2) at the Project site. As part of this initiative, Rosemont retained Wood to evaluate alternative TSF locations and to develop the design of the TSFs. The TSF sites were selected based on a combination of environmental, engineering, land ownership and economic factors. The PFS level design drawings for the new TSFs have been developed using the criteria described below. A general layout is shown in Figure 3-1.

Each of TSF-1 and TSF-2 consists of multiple cells. For each cell, a TSF starter dam (start phase) will first be constructed using locally borrowed soil and/or waste rock; the main starter dam along the downgradient edge of each cell will then be raised by centerline construction methods, and in some areas, followed by the upstream construction method until the final dam configuration is achieved. For the remainder of each cell perimeter, where there is sufficient cyclone tailings sand to reach ultimate dam configuration, the starter dam will be raised via the centerline construction method. The following table presents a summary of dam configurations and raise construction methods for the critical sections of TSF-1 along and TSF-2 with the interim configurations (i.e., starter dam, and centerline raise) and final configuration with the upstream raise configuration.

Table 3-1: Summary of Dam Configurations and Raising Method

TSF Section	Starter Dam Foundation Elevation (Downstream Toe)	Final Dam Foundation Elevation (Downstream Toe)	Starter Dam Crest Elevation	Centerline Raise Crest Elevation	Upstream Raise or Final Crest Elevation
TSF-1A	3,645	3,623	3,690	3,840	3,890
TSF-1B	3,982	4,002	3,993	4,147	4,197
TSF-2A1	4,166	4,149	4,215	4,280	4,350

TSF Section	Starter Dam Foundation Elevation (Downstream Toe)	Final Dam Foundation Elevation (Downstream Toe)	Starter Dam Crest Elevation	Centerline Raise Crest Elevation	Upstream Raise or Final Crest Elevation
TSF-2A2	4,359	4,345	4,490	4,540	4,600
TSF-2B	4,159	4,142	4,215	4,280	4,350

Note: Elevations presented in feet as defined by the North American Vertical Datum (NAVD) of 1988. Sections of TSF-1A, TSF-1B, TSF-2A1, TSF-2A2, and TSF-2B are shown in Figures 3-2 through 3-6 respectively. Among them, Section TSF-2A crosses two separate cells of TSF-2, which are illustrated in Figures 3-4 and 3-5 individually.

As summarized in Table 3-1 and illustrated in Figures 3-2 through 3-6, the main starter dam along the downgradient edge of each individual cell will be sequentially raised using the coarse fraction tailing sands (cyclone underflow) in a centerline manner (centerline phase). The tailings will be separated using hydro-cyclones into the sand and fine fractions. The sands will be placed downstream of the starter dam and the fine fraction will be deposited upstream. The cyclone sands provide a more permeable zone for control of the phreatic level in the TSF embankment. Criteria for the operation of the TSF will be developed to maintain a minimum length of exposed tailing beach between the supernatant decant pool and the embankment crest. Prior to the start of centerline phase, an inclined chimney drain will be constructed over the upstream face of the starter dam, overlain by a layer of cyclone sand to further promote vertical drainage toward an underdrain impoundment system. The chimney drain, underdrain impoundment systems, and cyclone sands in the embankments are included in the facility design to improve recovery of tailings water and to prevent the critical structural zones of the embankment (i.e. downstream shell zone of cyclone sand and starter dam material) from becoming saturated.

Along a portion of the downgradient edge of an individual cell, the facility will be raised using upstream techniques (upstream phase) where there is not sufficient cyclone sand, based on initial inputs regarding tailings production rates provided by Hudbay's tailings process design consultant (Paterson & Cooke), to continue the centerline raise method. This method involves constructing embankments in discrete lifts using compacted tailings or engineered fill, and spigotting whole tailings from the crest of the embankment. Each upstream embankment raise will be approximately ten-ft in height using a compacted berm fill material. Upon completion of each lift, the next lift will be stepped inboard to create an overall slope ratio of three horizontal to one vertical (3H:1V). Compacted berm fill can be either a locally borrowed soil, select waste rock, or tailings from the impoundment if the materials meet the specification for gradation and compaction.

Engineering analyses were performed to evaluate the tailings disposal operations during the start phase (starter dam), interim phase (centerline raise), and final phase of each TSF cell. Evaluations of the impoundment stability, storage capacity and stormwater containment were performed.

The design and performance of the TSFs have been evaluated using the individual BADCT approach as described in the ADEQ Arizona Mining BADCT Guidance Manual (ADEQ, 2004). The design, construction and operational BADCT elements of the TSFs consist of the following subsections.

3.1 Discharge Control

The TSFs will use the following site characteristics and operational practices to establish the reference design:

- Bedrock, present at shallow depths over the majority of the TSF basin footprints, functioning as a natural geologic liner (Piteau, 2022);
- Construction of alluvial cutoffs and seepage collection systems along the main drainages beneath both TSFs;
- Construction of an impoundment underdrain system within the TSF impoundment basins to promote reclaim water recovery, and reduce pore pressure within the TSF embankments;
- Construction of a chimney drain on the upgradient face of the starter dam, leading to the impoundment underdrain system, to assist in the control phreatic levels in the tailings embankment;
- The use of cycloned tailings construction techniques to obtain dilatant critical state behavior in critical portions of the embankment structural zone, to prevent potential for liquefaction;
- Diversion of unaffected/non-contact upgradient stormwater runoff around the tailings facility where possible; and
- Channels and berms for the collection of contact stormwater runoff from the downstream slopes of the tailings embankments.

The details of these discharge control elements are shown on the PFS level design drawings.

3.2 Site Preparation

The subgrade areas of the TSF starter dam embankments, and the area of impoundment for the discharge control treatment, will be stripped of existing vegetation, debris, and other deleterious materials. Areas designated to receive embankment fill will be further prepared by the removal of any loose alluvial or colluvial soils. For fill placement in areas of the site where cut slopes are steeper than 4:1 (horizontal: vertical), the area will be benched to reduce the potential for slippage between existing slopes and fills. Benches will be wide enough to accommodate compaction and earth moving equipment, and to allow placement of horizontal lifts of fill.

3.3 Surface Water Control

This is addressed in the companion Site Water Management Plan (SWMP) (Wood, 2022).

3.4 Embankment Stability Design

This is presented in Sections 4.0 through 5.0 of this technical memorandum.

3.5 Construction Quality Assurance

A Construction Quality Assurance (CQA) Plan will be developed for the TSFs in future stages of the Project. The purpose of the plan will be to provide a Project-specific technical guide to ensure a quality project, defensible documentation and conformance with the design drawings and technical specifications. The plan will be developed using the guidance provided by Appendix D of the BADCT Guidance Manual for the Mining Category.

3.6 Operational Measures

An Operations, Maintenance and Surveillance (OMS) plan will be developed for the TSFs in future stages of the development of the Project.

3.7 Closure Conceptual Design

A Conceptual Closure Plan has been developed for the TSFs. Refer to the Conceptual Closure Plan for facility closure concepts.

4.0 Stability Analysis

Wood performed static and pseudo-static limit equilibrium analyses and seismic displacement analyses to demonstrate the TSFs, as designed, meet current engineering standards for static and seismic hazard. TSF-1 and TSF-2 have been designed to meet or exceed the prescriptive BADCT requirements for a tailings dam as described in the ADEQ Arizona Mining BADCT Guidance Manual (ADEQ, 2004).

4.1 TSF Critical Cross Sections and Construction Phases

Critical cross sections (TSF-1A, TSF-2A1 and TSF-2A2) were selected in order to evaluate stability of TSF-1 and TSF-2. The selected sections are along the maximum heights and representative configurations of the tailings dams at different cells at the locations shown on Figure 3-1. Moreover, two more sections (TSF-1B and TSF-2B) were selected in order to evaluate potential impact on the public accesses and human life under extreme earthquake event, such as the MCE. Stability analyses were performed for these sections to evaluate the slope stability of the TSFs during and after construction. The stability analyses include construction stage analyses. Both static and pseudo-static analyses were performed.

Typical geometry of the TSFs consists of four main components: (1) native soils and rock, (2) starter dam and embankment materials (including embankment fills and chimney drain), (3) cyclone sand and compacted Berm fill, and (4) fine tailings and whole tailings. Downstream slopes of all embankments are 3H to 1V (horizontal to vertical) and upstream slopes of starter dam are designed at 2H:1V.

The final slope geometries of the critical cross sections used in this analysis are provided in Figures 3-2 through 3-6 for TSF-1A, TSF-1B, TSF-2A1, TSF-2A2, and TSF-2B respectively.

4.2 Geotechnical Design Criteria

The construction and operation of the facility should follow the BADCT for a specific mining facility type and site in accordance with A.R.S. 49-243.B.1. This statute requires all permitted facilities to utilize BADCT in their design, construction and operation while considering various factors depending on whether the facility is new or existing. The Arizona BADCT geotechnical criteria for static and dynamic stability of tailings dams are summarized in Table 4-1 and Table 4-2.

Table 4-1: BADCT Static Stability Design Criteria

Static Stability Design Criteria (For Both Prescriptive and Individual Approaches)	
Facility	**Minimum Required Factor of Safety (FoS)**
Embankments Constructed on Tailings or Constructed with Tailings	Final Construction Stage; 1.5 Without Testing 1.3 With Testing Intermediate Construction Stage; 1.3 Without Testing

Note: The minimum factor of safety "with testing" refers to site-specific testing of material shear strengths and quality control testing (e.g., moisture content, density and grain size) during construction. The testing program should establish drained shear strength parameters for long-term (static) stability analysis and, where appropriate, undrained shear strength parameters for rapid loading conditions (e.g., earthquake or rapid drawdown).

Table 4-2: BADCT Dynamic Stability Design Criteria

Dynamic Stability Design Criteria		
Facility	**Prescriptive BADCT**	**Individual BADCT**
Embankments Constructed on Tailings or Constructed with Tailings	For final construction stages: Computed pseudo-static FoS 1.1, without testing. Computed pseudo-static FoS 1.0, with testing. For intermediate construction stages: Computed pseudo-static FoS 1.0, with or without testing. (See Note 2)	For final construction stages: Computed pseudo-static FoS 1.1, without testing. Computed pseudo-static FoS 1.0, with testing For intermediate construction stages: Computed pseudo-static FoS 1.0, with or without testing. (See Note 2)
	and/or (See Note 3)	and/or (See Note 3)
	Liners and covers: Deformations of 1 foot, without geomembranes. Deformations of 6 inches, with geomembranes. Covers that are maintained: Deformations of 1 foot. (See Note 4)	Predicted deformations shall not jeopardize containment integrity.

Notes: FoS = factor of safety

1. Refer to Section 4.7 for discussion of design earthquake selection.
2. Applicable only when material types involved (e.g., clayey soils or large, coarse rock fragments) do not exhibit high potential for pore-water pressure buildup and associated significant strength loss under loading.
3. For conditions with high potential for pore-water pressure buildup and associated significant strength loss, deformation analyses must be completed. Also, if loss of life or major environmental impacts is potentially imminent under failure conditions deformation analyses should be performed.
4. Larger deformations may be acceptable if engineering evaluations are provided to demonstrate that they will not jeopardize containment integrity.

The stability design criteria selected for this Project are presented in Table 4-3. The minimum acceptable factors of safety defined by the individual BADCT criteria for tailings impoundments were selected for both the static and pseudo-static analyses and conservatively consider the BADCT "without testing" criteria. The same stability design criteria of pseudo-static analyses have been used for post-earthquake liquefaction conditions. The design criteria are generally consistent with that of the previous Rosemont TSF designs and studies; the only exception is the design seismic event. Refer to Section 4.7 of this technical memorandum and Lettis Consultants International (LCI) (2022) for additional discussions of maximum probably earthquake (MPE) versus MCE.

Table 4-3: Geotechnical Stability Criteria for Tailings Facility Design

Loading Conditions	Analytical Method	Criteria
Static Slope Stability	Two dimensional limit static equilibrium analysis.	Intermediate Construction Stages, with consideration of pore pressures at impoundment build rates FoS= 1.3 End of Construction with steady-state pore pressure conditions FoS = 1.5 (ADEQ, 2004)
Pseudo-Static Slope Stability	Two dimensional limit equilibrium analysis with design earthquake static thrust of 0.17g, corresponding to a 10,000-year recurrence interval design earthquake (1percent [%] probability of exceedance in 100 years).	Intermediate Construction Stages, with consideration of pore pressures at impoundment build rates FoS= 1.0 End of Construction with steady-state pore pressure conditions FoS = 1.1 If the calculated FoS is less than 1.0, a permanent deformation analyses will be required to demonstrate that the calculated permanent deformations will not jeopardize the containment integrity (ADEQ, 2004)
Earthquake-Induced Slope Displacements	An empirical method by Bray and Travasarou (2007) to estimate potential seismic slope displacements under the MCE.	Predicted deformations shall not jeopardize containment integrity and endanger the human life (ADEQ, 2004)

Note: FOS = factor of safety

BADCT (2004) requires that "*seismic stability of evaluations should be based on the design earthquake which ranges between the Maximum Probable Earthquake (MPE) and the Maximum Credible Earthquake (MCE). The MPE is the largest earthquake with a 100-year return interval." (BADCT 2004, Section 2.5.2.5)*. Appendix E (BADCT 2004, E.2.4.3) furthers requires that *"where human life is potentially threatened, the maximum credible earthquake (MCE) should be used. MCE is the maximum earthquake that appears capable of occurring under presently known tectonic framework."* MPE according to BADCT is defined as the maximum earthquake that is likely to occur during a 100-year interval (80% probability of not being exceed in 100 years) and shall not be less than the maximum historic event. According to LCI (2021), historical seismicity in the site region is sparse with only five events within 50 km of the Project site, with the largest and closest event to the Project area in 1887 with moment magnitude (M) of 5.7; the Project area is located in a region of relatively low historical seismicity.

Considering the above, the design earthquake event that is selected for the for pseudo-static analyses with a 10,000-year recurrence interval is much more conservative than the MPE. Corresponding to the design earthquake event for pseudo-static analysis, probability of not being exceeded in 100 years is about 99%; this is equivalent to 1% exceedance probability in 100 years, which is significantly less than 20% exceedance probability in 100 years of MPE. This design earthquake event is also consistent with the most stringent criterion of the probabilistic seismic hazard analysis method in the recently published Global Industry Standard on Tailings Management (GISTM, 2020), and represents most current industrial standard to guide tailings storage facility designs and managements.

Moreover, the MCE is also considered for estimating earthquake-induced permanent slope displacements in the areas adjacent to the county roads, and the results are used to assess potential impact on human life and closure components, such as a tailings cover. This is consistent with the requirements of BADCT (Appendix E).

4.3 Material Properties

The material properties used in the stability analyses for different soil layers were estimated based on boring logs, previous investigations by Wood, AMEC (a precedent company of Wood) and other parties, as well as literature data. The foundation material consists, in general, of alluvium (including GP, SP and SW soil types), highly to completely weathered rock, and moderate to slightly weathered rock. To simplify the model assumptions and material properties, the foundation material was conservatively considered to be an alluvial/colluvial soil for the entire foundation depth evaluated, consistent with the past designs of the TSF (AMEC, 2009). The foundation soil within the TSF footprints was generally logged as dense to very dense and coarse grained. Considering the dense nature of the material, results of direct shear tests on remolded soil samples were used to represent both the Foundation Soil and Starter Embankment Fill (to be constructed using the locally borrowed alluvium/colluvium). Figure 4-2 presents a summary of shear strengths tested on remolded foundation soils of TSF, along with the strength envelope used for stability modeling. The comparison shows that an effective stress strength represented by a cohesion of 0 pound per square foot (psf) and a friction angle of 36 degrees is conservatively representative of Foundation Soil and Starter Embankment Fill. The same strength has been used in the past TSF designs (AMEC, 2009). Starter dams may also be constructed using waste rock, the strength of which should be higher than the currently used value as evaluated previously (AMEC, 2009). Drain rock material proposed for construction of the chimney drain is a rockfill and will also be conservatively represented by strength of Starter Embankment Fill with a cohesion of 0 psf and a friction angle of 36 degrees.

Numerous testing has been performed on tailings materials, including the following:

- A design summary containing index testing on two tailings samples referred to as "Colina" and "MSRD-1" (AMEC, 2009);
- Data of additional tailings testing following the original 2009 design (AMEC, 2010, 2013, 2014);
- A summary report containing new testing data of four tailings samples, referred to as "Base 1", "Base 2", "Base 3" and "Sub 5A" (Knight Piesold [KP], 2015).

While strength and compaction characterization testing of the past Rosemont Copper Project studies have been focused on dry stack and filtered tailings, the index testing results are useful in support of this study. Figure 4-2 summarizes index tests that have been performed on whole tailings by AMEC (2009) to support the 2009 design and by KP (2015) as the most current tailings testing data, including gradation curves, Atterberg limits and specific gravity. Note that KP considered a mine plan and pit development plan to allow for in-pit blending of ore from the concurrent phases of mining to reduce clay variability to the process, which led to coarser tailings being tested as compared with that of the other prior studies. Wood understands that Rosemont will continue the path of looking for opportunities in reducing clay variability and producing coarser tailings. The tailings characterization data by AMEC (2010, 2013, 2014) generally fall within the range shown in Figure 4-2 with the finer tailings represented by that data of AMEC (2009) and the coarser tailings represented by the data of KP (2015).

The tailings are classified primarily as sandy silt (ML) or sandy silty clay (ML-CL) according to the testing results of KP (2015). Based on the previous field and laboratory tests for similar projects in Arizona and also based on the literature data, an effective friction angle of 30 degrees with 0 cohesion for the tailings slimes (cyclone overflow) and 34 degrees with 0 cohesion for tailings cyclone sands (cyclone underflow) was selected as appropriate for use in the effective stress analyses for this analysis. The compacted berm fill and spigotted whole tailings were also molded with effective friction angle of 34 degrees with no cohesion and 30 degrees with no cohesion, respectively.

A shear strength ratio (Su/p'), with the ratio being the undrained shear strength, Su, normalized by the effective mean normal stress, p', was used to account for generation of pore-water pressure for undrained conditions. An undrained strength ratio of 0.25 is considered reasonable for initial design purposes. Several published undrain shear strengths of copper tailings were reviewed and plotted against the assumed value used in this analysis. As shown in Figure 4-3, the undrained strength ratio is a reasonably conservative value to represent copper tailings, particularly under relatively low overburden pressure range applicable to this Project (as shown in critical failure paths of modeling results). However, since tailings strength depends on the processing and depositional processes used, it is necessary that the owner or owner's representative verify and confirm that the strength parameters adopted in the design phases are representative of the constructed facility.

The strength properties and average unit weights selected for different materials are presented in Table 4-4, along with supporting references for selection of properties.

Table 4-4: Material Prosperities Assigned for Stability Analyses

Material	Moist Unit Weight (pcf)	Effective Angle of Friction (degrees)	Cohesion (psf)	Undrained Strength[3], Su/p'
Foundation Soil[1]	125	36	0	N/A
Starter Embankment Fill[1]	125	36	0	N/A
Drain Rock[2]	125	36	0	N/A
Coarse Tailings[2]	125	34	0	N/A
Fine Tailings[2]	100	30	0	0.25
Compacted Berm Fill[2]	120	34	0	N/A
Whole Tailings[2]	110	30	0	0.25

Notes: pcf = pounds force per cubic foot; psf = pounds force per square foot; N/A = Not Applicable
1. Tested strength value of this study; refer to Figure 4-1.
2. Assigned strength values based on review of existing testing data, similar projects in Arizona and literature search.
3. Undrained shear strengths of each material where applicable is reduced by 20% for pseudo-static analyses. For post-liquefaction, the shear strength ratio could be as low as 0.1 in according with Ishihara (1996) and tested PI values.

4.4 Seepage Evaluation

To support stability analyses, steady-state seepage analyses of the critical sections were completed to assess the water and pore-water pressure conditions during construction of the tailings dam and to evaluate dam stability a maximum pool condition. For seepage modeling, Wood assumed an upstream water surface with the pool at least 400-ft away from the tailings dam crest for each of three simulated construction stages: starter dam construction stage, cyclone tailing centerline stage and upstream dam stage. The seepage analysis was completed using the two dimensional computer program Slide2 (Rocscience, 2021) and assigned saturated hydraulic conductivity values and unsaturated hydraulic functions for the various materials of the embankment and the foundation. Slide is a computer code used to model the saturated and unsaturated flow of water within porous materials. Note that the seepage evaluation herein is intended to support the limit equilibrium stability analyses documented herein. The seepage estimate for the overall TSFs is documented in a separate submittal.

The hydraulic conductivity values utilized in the analyses for each specific material are summarized in Table 4-5. Hydraulic conductivities were estimated using the tested values on remolded foundation soil, using the D10 size (diameter through which 10 percent [%] of soil/rock passes), and were also based on the previous reports (AMEC, 2009; KP, 2015) and literature review. Anisotropy of the materials has not been considered at this stage. Unsaturated soil conditions were simulated based on “built in” models within the software for each representative soil, including coarse tailings as a sand, fine tailings as a silt, and other fills as a general soil. The values used in the analyses are included in Table 4-5.

Table 4-5: Material Prosperities Assigned for Seepage Analyses

Material	Saturated Hydraulic Conductivity K_{sat}, ft/sec	References
Foundation Soil	8.0×10^{-4}	Average in-situ testing result by Piteau in 2021
Starter Embankment Fill	2.5×10^{-4}	Average value of testing results (Wood, 2021)
Drain Rock[1]	3.3×10^{-3}	See notes
Coarse Tailings[1]	3.0×10^{-4}	See notes
Fine Tailings[1]	3.0×10^{-6}	See notes
Compacted Berm Fill[1]	3.0×10^{-4}	See notes
Whole Tailings[1]	3.0×10^{-6}	See notes

Notes: ft/sec = foot per second; N/A = Not Applicable
1. Assigned values based on review of existing testing data, similar projects in Arizona and literature search.

The seepage analysis results show that a phreatic surface does not develop through the embankments during all stages of construction. Due to a relatively high permeable foundation soil and proposed underdrain/seepage collection system, the results also reflect the transmission of the water through dam foundations, planned chimney drain and impoundment drain systems. Based on these results, the downstream slope of the embankment is not affected by the phreatic surface. Therefore, additional stability analyses considering other effects, such as liquefaction of embankment fills and coarse tailings, are not required at this stage. Simplified and representative piezometric surfaces were developed based on the results of seepage analysis, and used for stability modeling as shown in Figure 4-4, a representative section for Section TSF-1A; these piezometric surfaces for stability modeling are more conservative than the results of steady-state seepage analyses, but are considered appropriate at this level of study.

4.5 Limit Equilibrium Stability Analysis

A series of stability analyses were performed using Slide2 (Rocscience, 2021), a commercially available computer program which enables the user to conduct limit equilibrium slope stability calculations by a variety of methods and search routines. For the failure mechanisms considered in the analyses, slope stability was evaluated using limit equilibrium methods based on Morgenstern-Price’s method of analysis (Morgenstern-Price, 1965). Morgenstern-Price’s method is a method of slices (consideration of potential failure masses as rigid bodies divided into adjacent regions or "slices," separated by vertical boundary planes) that satisfies both moment and force equilibrium. Both circular and non-circular (linear) failure surfaces were evaluated. Slide2 is also capable of analyzing seepage, which was coupled with stress analysis in order to evaluate the sequential deposition of tailings and pore-water distribution. The slope stability analyses aimed to find the minimum factor of safety for the critical sliding surface based on assumed shear strengths parameters for each one of the three phases analyzed: starter dam phase, cyclone centerline phase and upstream dam phase.

The method used to evaluate the stability of the TSFs was based on the principle of limit equilibrium (i.e., the method calculates the shear strengths that would be required to just maintain equilibrium along the selected failure plane, and then determines a safety factor by dividing the available shear strength by the equilibrium shear stress). Consequently, safety factors calculated by the limit equilibrium method indicate the percent by which the available shear strength exceeds, or falls short of, that required to maintain equilibrium. Therefore, safety factors in excess of 1.0 indicate stability and those less than 1.0 indicate instability. The greater the mathematical difference between a safety factor and 1.0, the larger the margin of safety (for safety factors in excess of 1.0), or the more extreme the likelihood of failure (for safety factors less than 1.0).

Figures 4-5 through 4-55 show the results obtained from the limit equilibrium analysis.

4.6 Static Analyses (Effective and Total Stress Analyses)

Under static conditions, the effective stress analyses (ESA) and total stress analyses (TSA) were used for the stability evaluation. The ESA method is based on the assumption that excess of pore-water pressures will not be generated by the shearing process. This method is appropriate for long-term slope stability evaluation. The TSA method is conservatively used with the assumption that excess of pore-water pressure will be generated during construction and the material will be sheared in an undrained condition.

The results of the static stability analysis (effective and total stability analyses) and the factors of safety for the critical failure surfaces for each cross section are presented in Figures 4-5 through 4-34 and are summarized in Table 4-6. The minimum FoS obtained for each of the critical cross sections is higher than the required minimum FoS prescribed by BADCT, as described in the design criteria section (Section 4.2). The stability analyses show that the FoS is higher than both the required FoS of 1.5 for the end of construction condition and FoS of 1.3 for the interim construction condition.

Table 4-6: Summary of Stability Analyses Results (Static)

Section	Case	Calculated FoS – Static	
		Undrained/TSA (Min. FoS > 1.3)	Drained/ESA (Min. FoS > 1.5)
TSF-1A	Starter Dam	1.90	1.90
	Centerline Raise	2.03	2.03
	Final Configuration	2.00	2.03
TSF-1B	Starter Dam	2.05	2.05
	Centerline Raise	2.04	2.04
	Final Configuration	2.00	2.03
TSF-2A1	Starter Dam	1.89	1.89
	Centerline Raise	2.03	2.03
	Final Configuration	1.78	2.02
TSF-2A2	Starter Dam	1.85	1.85
	Centerline Raise	2.06	2.06
	Final Configuration	1.93	2.05
TSF-2B	Starter Dam	1.87	1.87
	Centerline Raise	2.03	2.03
	Final Configuration	1.78	2.02

Notes:
ESA - effective stress analyses
FoS – factor of safety
TSA - total stress analyses

4.7 Pseudo-Static Analyses and Post-Earthquake Analyses

Refer to LCI (2021) for a site-specific seismic hazard evaluation. Values of peak horizontal ground accelerations obtained from the analyses are tabulated in Table 4-7.

Table 4-7: Peak Horizontal Ground Acceleration Values for Copper World Project (LCI, 2021)

Return Period [years]	Exceedance Probability in 50 years	Peak Ground Acceleration (PGA), Vs = 2,500 ft/s
		[g]
475	10%	0.024
975	5%	0.039
2,475	2%	0.073
5,000	1%	0.115
10,000	0.5%	0.173

Notes:
ft/sec = foot per second

As discussed in the Section 4.2, the 10,000 year return period event, with a PGA of 0.173g, was selected as the design event for the pseudo-static analyses in support of the TSF design.

Pseudo-static-based analyses are commonly used to apply equivalent seismic loading on earthfill structures. In an actual seismic event, the peak acceleration would be sustained for only a fraction of a second. Actual seismic time histories are characterized by multiple-frequency attenuating motions. The accelerations produced by seismic events rapidly reverse motion and generally tend to build to a peak acceleration that quickly decays to lesser accelerations. Consequently, the duration that a mass is actually subjected to a unidirectional, peak seismic acceleration is finite, rather than infinite. The pseudo-static analyses conservatively models seismic events as constant acceleration and direction (i.e., an infinitely long pulse). Therefore, it is customary for geotechnical engineers to take only a fraction of the predicted peak maximum site acceleration when modeling seismic events using pseudo-static analyses (Hynes-Griffin and Franklin, 1984). The pseudo-static analysis incorporated a pseudo-static coefficient of 0.09 which is ½ of the design PGA of 0.173g (corresponding to the 10,000-year return period), in accordance with the design criteria and Hynes-Griffin and Franklin (1984).

The pseudo-static analyses were used to determine the FoS under simulated earthquake conditions and determine the yield acceleration required to cause slope instability. The pseudo-static factor of safety limit equilibrium slope stability method is used as a screening tool to determine if more rigorous dynamic analyses is needed to model the stability of the facility slopes under earthquake conditions. More detailed deformation analyses would be required if the slope stability FoS did not meet the acceptance criteria (less than 1). The yield acceleration was determined by incrementally increasing the pseudo-static coefficient until the resulting factor of safety was equal to 1.0.

Cyclic softening or liquefaction are not anticipated for most materials given that the majority of embankment materials will not be saturated and that the foundation is too dense to liquefy or soften. However, the majority of the fine tailings and whole tailings will be saturated and could be subject to liquefaction and strength reduction during an earthquake. Therefore, for pseudo-static analyses, a strength reduction of 20% is applied to fine tailings and whole tailings following recommendations of Hynes-Griffin and Franklin (1984). Moreover, a post-liquefaction strength is applied to coarse tailings that could be saturated along with fine tailings and whole tailings for post-earthquake analyses; based on tested Atterberg limits and literature review (Ishihara, 1996), a strength ratio of 0.10 is used to represent the liquefaction of coarse tailings when saturated (Figure 4-50).

The results of the pseudo-static stability and post-earthquake analyses, and the FoS for the critical failure surfaces for each cross section, are presented in Figures 4-35 through 4-49, Figures 4-51 through 4-55, and are summarized in Table 4-8. The minimum factor of safety obtained for the critical cross sections is higher than the required minimum factor of safety prescribed by BADCT, as described in Section 4.2.

Table 4-8: Summary of Stability Analyses Results (Pseudo-Static and Post-Earthquake)

Section	Case	Calculated FoS – Seismic	
		Pseudo-Static (Min. FoS > 1.1)	Post-Earthquake (Min. FoS > 1.1)
TSF-1A	Starter Dam	1.50	NA
	Centerline Raise	1.55	NA
	Final Configuration	1.24	1.13
TSF-1B	Starter Dam	1.64	NA
	Centerline Raise	1.56	NA
	Final Configuration	1.17	1.12
TSF-2A1	Starter Dam	1.47	NA
	Centerline Raise	1.55	NA
	Final Configuration	1.18	1.14
TSF-2A2	Starter Dam	1.45	NA
	Centerline Raise	1.57	NA

Section	Case	Calculated FoS – Seismic	
		Pseudo-Static (Min. FoS > 1.1)	Post-Earthquake (Min. FoS > 1.1)
	Final Configuration	1.23	1.18
TSF-2B	Starter Dam	1.47	NA
	Centerline Raise	1.55	NA
	Final Configuration	1.18	1.13

4.8 Seismic Slope Displacement Analyses

In addition to pseudo-static analyses for evaluating the seismic performance of a slope, stability can also be assessed in terms of permanent earthquake-induced displacement (δ). Displacement is a suitable measure to support a TSF design since damage from seismic shaking incurred by the slope ultimately governs its serviceability after the earthquake. Newmark (1965) surmised that the FoS of a slope would vary with time as the destabilizing inertial forces imposed on the slope varied throughout the duration of earthquake shaking. When the earthquake-induced inertial forces acting on a failure mass are large enough to exceed the available material resistance, the FoS of the slope would fall below one, thereby initiating an episode of permanent downslope displacement. Displacement continues until the inertial forces fall below the available resistance, and the velocities of the sliding mass and underlying ground coincide. Newmark (1965) proposed that the physical mechanism of earthquake-induced displacement of a soil mass over a shear surface could be approximated mathematically after the dynamic behavior of a block sliding along an inclined plane. A variety of different displacement methods can be used to compute the estimated magnitude of seismic displacement.

In general, performing a seismic displacement analysis to compute earthquake-induced displacement involves the following steps:

- A limit equilibrium pseudo-static slope stability analysis to determine the seismic yield coefficient (k_y) (seismic resistance) and the geometry of the critical pseudo-static failure surface;
- Displacement calculation to estimate the magnitude of earthquake-induced downslope movement of the slide mass.

For this work, the displacement method by Bray and Travasarou (2007) was used to compute the seismic-induced displacement. A description of each step in the analysis is discussed in the following sections.

- *Step 1: Computation of the Seismic Yield Coefficient:* In the context of earthquake-induced displacement, k_y is interpreted as the minimum acceleration required to initiate downslope displacement of a slide mass and essentially represents the slope's resistance to earthquake-induced accelerations. Note that if the seismic yield coefficient exceeds the seismic accelerations (i.e., k_y > accelerations), no permanent displacement will accrue.

  As discussed in Section 4.7, the seismic yield coefficient (k_y) is determined by performing a trial-and-error pseudo-static analysis using Slide2 whereby the horizontal seismic coefficient (k) is incrementally increased until the FoS reduces to one (FS = 1.0) (defining incipient failure); the seismic coefficient at this point is taken as k_y. A slip surface search is performed simultaneously to determine the critical surface for each trial. The surface corresponding to k_y is referred to as the critical pseudo-static failure surface. This surface defines that slide mass that detaches and moves down slope in the earthquake and is the surface on which seismically-induced displacements are assumed to occur.

- *Step 2: Seismic Displacement Calculation:* The magnitude of earthquake-induced displacement (δ) was calculated using the Bray and Travasarou (2007) method. This is a simplified, equation-based method based on the sliding-block model (Newmark, 1965) described earlier. The Bray and Travasarou (2007) method was developed using 688 ground motions from 41 different earthquake events with moment magnitudes that range from 5.5 to 7.6. The empirical model accounts for compliance and flexibility of the slide mass and models the dynamic response of the slope and the sliding response of the slide mass simultaneously as a single coupled behavior. Bray and Travasarou (2007) developed the following expression for flexible slide masses with a fundamental period (Ts) between 0.05 and 2 s:

$$\ln(\delta) = -1.10 - 2.83 \ln(k_y) - 0.333 (\ln(k_y))^2 + 0.566 \ln(k_y) \ln(S_a(1.5\ T_s)) + 3.04 \ln(S_a(1.5\ T_s)) - 0.244 (\ln(S_a(1.5\ T_s)))^2 + 1.50\ T_s + 0.278 (M-7)$$

where δ (cm) is the permanent displacement (in cm, note 2.54 cm = 1 inch), k_y (g) is the seismic yield coefficient, $S_a(1.5\ T_s)$ (g) is the spectral acceleration of the ground motion at the degraded fundamental period of the slide mass, T_s (s) is the fundamental period of the slide mass, M (unitless) is the moment magnitude of the earthquake. This equation provides median (50th percentile) estimates of displacement. The term $S_a(1.5\ T_s)$ characterizes the seismic loading experienced by the slope and slide mass and was calculated from the response spectrum for the MCE event as shown in LCI (2021) (as shown in Figure 4-56). The term ($1.5\ T_s$) represents the degraded natural period of the slide mass and accounts for material non-linearity and stiffness degradation that occurs when soil materials are subjected to cyclic loading.

Sections TSF-1B and TSF-2B with adjacent public accesses were evaluated for potential impact on the public safety and human life, considering a design MCE in accordance with LCI (2021) with the following parameters: (1) M (moment magnitude) = 7.2; (2) PGA = 0.31 g, corresponding to the median horizontal acceleration response spectra. Refer to Figure 4-56 for the design spectra of MCE based on of LCI (2021), which is used to derive the value of $S_a(1.5\ T_s)$.

Results of the pseudo-static analysis for determination of k_y are summarized in Table 4-9. The corresponding critical pseudo-static failure surfaces for each section are shown in Slide2 outputs presented in Figures 4-57 and 4-58. Earthquake-induced displacement was computed for the MCE event using the Bray and Travasarou (2007) method. Estimated permanent displacements are summarized in Table 4-9.

Table 4-9: Summary of k_y Values and Estimated Permanent Earthquake-Induced Displacements

Section	Case	Seismic Displacement Calculation	
		Yield Acceleration, k_y (g)	Seismic Displacement (inches)
TSF-1B	Final Configuration Downstream Direction	0.143	< 1
TSF-2B	Final Configuration Downstream Direction	0.125	< 1

5.0 Conclusion and Discussions

All factors of safety meet or exceed the minimum design criteria for static, pseudo-static, and post-earthquake loading conditions as prescribed by Arizona Mining BADCT Guidance Manual (ADEQ, 2004). Moreover, calculated earthquake-induced permanent slope displacements under a design MCE are not anticipated to be significant enough to impact human life and public safety.

Additional geotechnical evaluations are recommended in order to confirm design assumptions for the raise of the TSF during all construction stages. Evaluations of the tailing materials shear strength and hydraulic conductivity, under the confining stresses imposed by the increased impoundment height, should be performed during construction and prior to the aforementioned elevation. Detailed staging relationships for the cyclone sand production and embankment material will be required.

Moreover, it is crucial to deposit the tailings following the deposition plan and maintain the tailings pools at the locations and limits as designed. The impoundment underdrain and seepage collection system will be designed to control the development of pore pressures at the base of the impoundment. Raise rates of the upstream construction must be managed with extreme caution; Monitoring of pore pressure conditions within the TSF embankments will be required. Upstream raise rates over ten-ft per year will need to be fully evaluated. An OMS manual and an emergency action plan be implemented during all stages of the facility construction, operation and closure.

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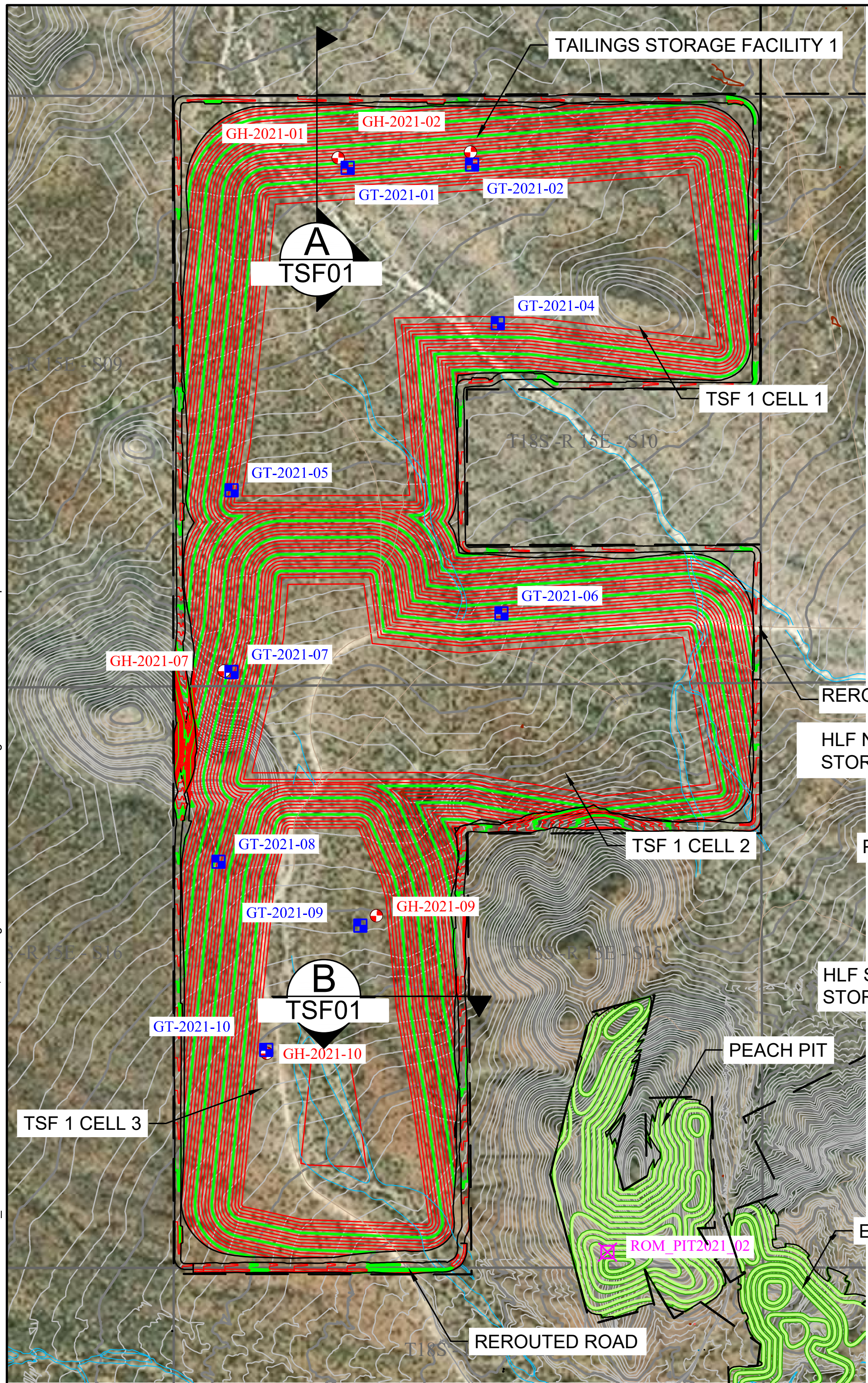
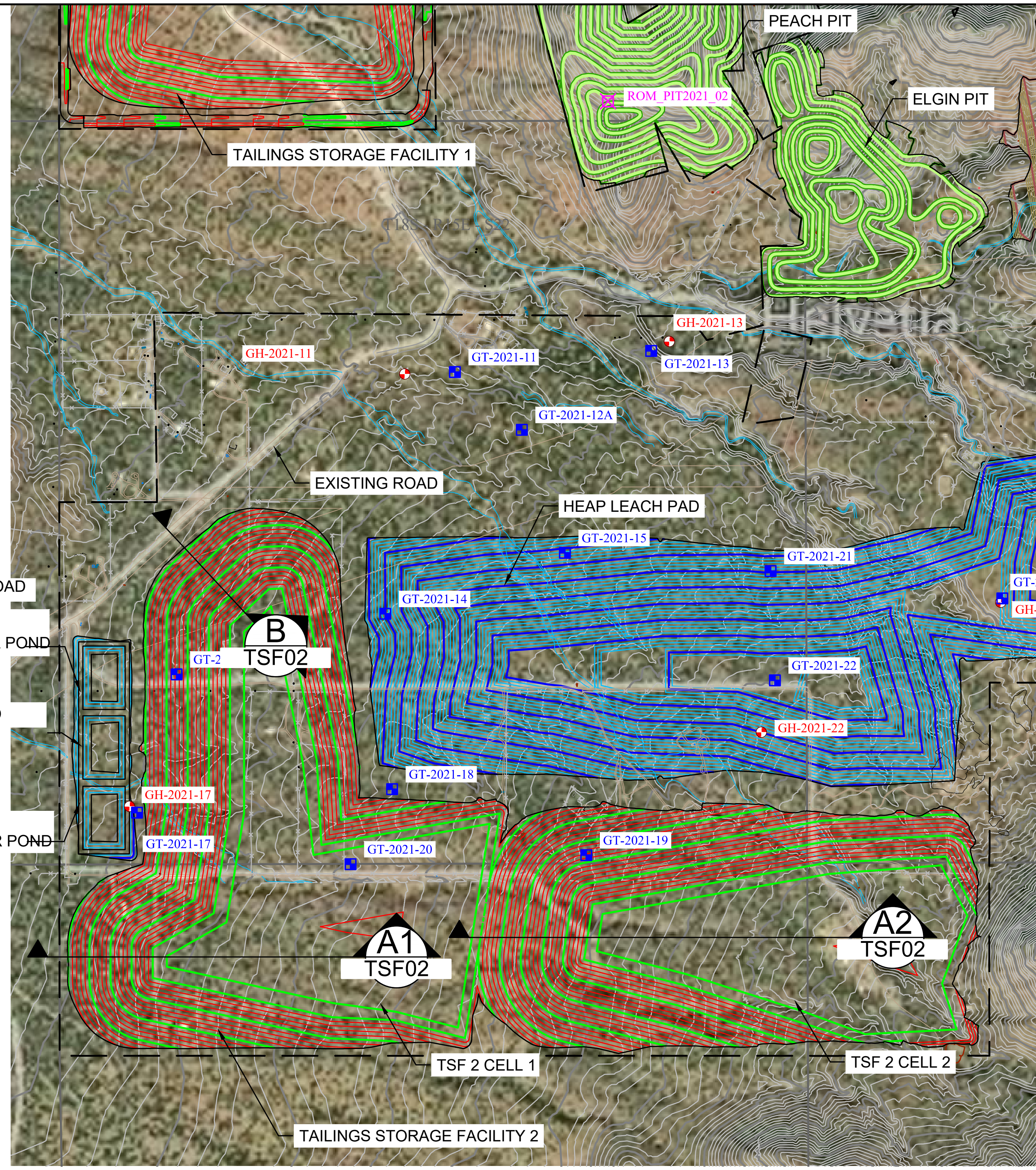
ACRONYMS AND ABBREVIATIONS

%	Percent
A.A.C.	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
APP	Aquifer Protection Permit
A.R.S.	Arizona Revised Statute
BADCT	Best Available Demonstrated Control Technology
CQA	Construction Quality Assurance
ESA	Effective Stress Analyses
ft	Feet/Foot
FoS	Factor of Safety
GISTM	Global Industry Standard on Tailings Management
HDPE	High-Density Polyethylene
HLF	Heap Leach Facility
KP	Knight Piesold
LCI	Lettisci Consultants International
M	Moment Magnitude
ML	Sandy Silt
ML-CL	Sandy Silty Clay
m/s	Meters per Second
mm	Millimeter
MCE	Max Credible Earthquake
MPE	Maximum Probably Earthquake
OMS	Operations, Maintenance and Surveillance
pcf	Pounds per Cubic Feet
PFS	Pre-Feasibility Study
PGA	Peak Ground Acceleration
psf	Pound per Square Foot
Project	Rosemont Copper World Project
Rosemont	Rosemont Copper Company
Su/p'	Shear Strength Ratio
SWMP	Site Water Management Plan
TSA	Total Stress Analysis
TSF	Tailings Storage Facility
TSF-1	Tailings Storage Facility 1
TSF-2	Tailings Storage Facility 2
TSA	Total Stress Analyses
Wood	Wood Environment & Infrastructure Solutions, Inc.
WRF	Waste Rock Facility

FIGURES





LEGEND:

GH-2021-01	BOREHOLE
GT-2021-01	TEST PIT
ROM_PIT2021_02	SURFACE SAMPLE

N

TSF 1 PLAN
SCALE: 1"=1500'

0 1500' 3000'

TSF 2 PLAN
SCALE: 1"=1000'

0 1000' 2000'

ROSEMONT COPPER WORLD PROJECT
PFS DESIGN STABILITY ANALYSES
TSF 1 AND TSF 2

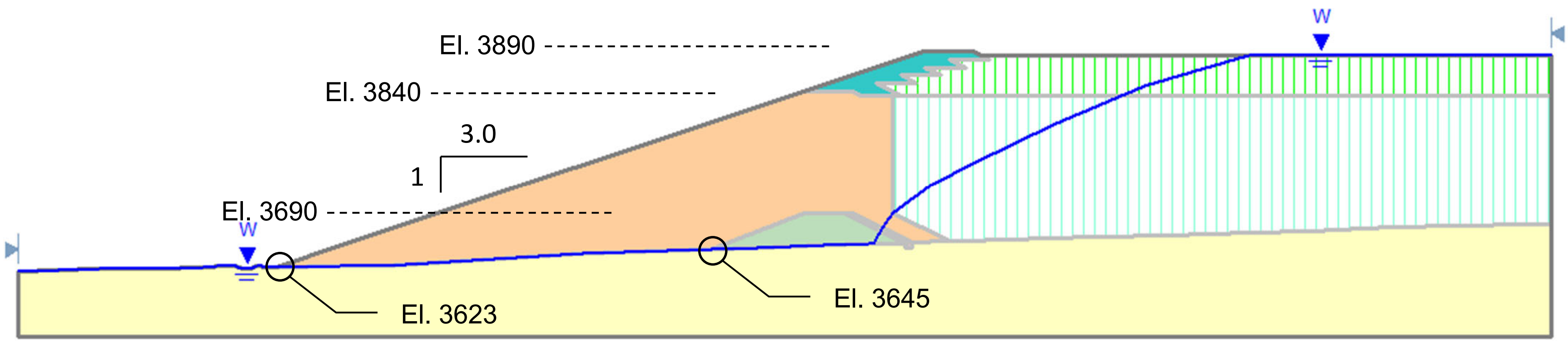
wood.

WOOD ENVIRONMENT & INFRASTRUCTURE SOLUTIONS
4600 E WASHINGTON ST, SUITE 600
PHOENIX, ARIZONA 85034
PHONE: 602-733-6000

Figure: 3-1

By: OAS | Date: 01/11/22 | Project No: 17-2021-4024

wood. Drawing Path: G:\Geotechnical\2021 Projects\17-2021-4024 Rosemont_RP21 Private Land Studies\14 CAD\FIG\, Drawing Name: FIG 3-1 TSF MEMO.dwg Plot Date: 01/11/22 - 4:28pm



Material Name	Color
Foundation Soil	
Starter Emankment	
Coarse Tailings	
Drain Rock	
Fine Tailings (Drained)	
Compacted Berm	
Whole Tailings (Drained)	

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Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-1A Final – Geometry

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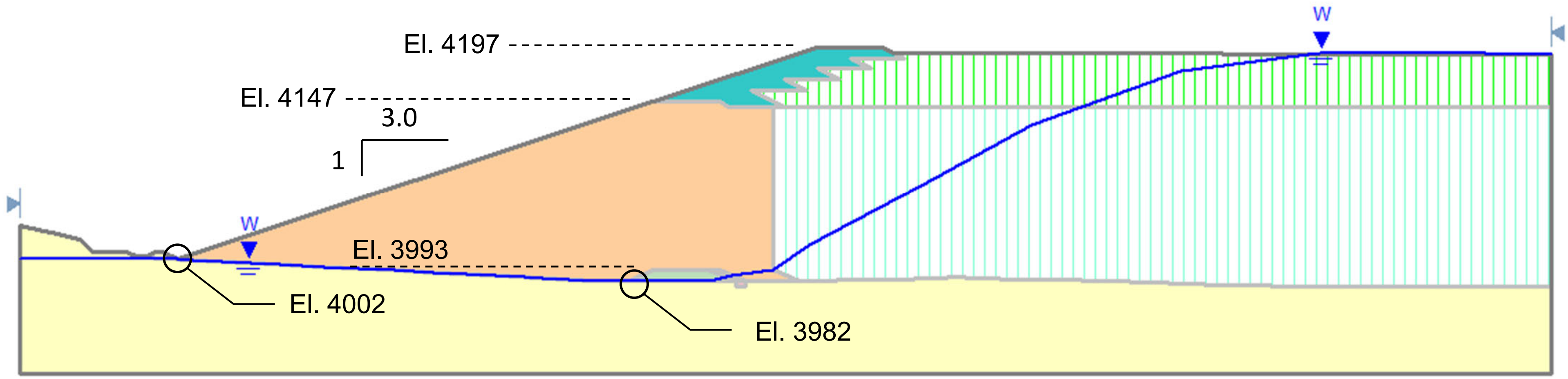
Figure 3-2

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021



Material Name	Color
Foundation Soil	
Starter Emankment	
Coarse Tailings	
Drain Rock	
Fine Tailings (Drained)	
Compacted Berm	
Whole Tailings (Drained)	

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PFS Design – TSF's
Stability Analyses

Section TSF-1B Final – Geometry

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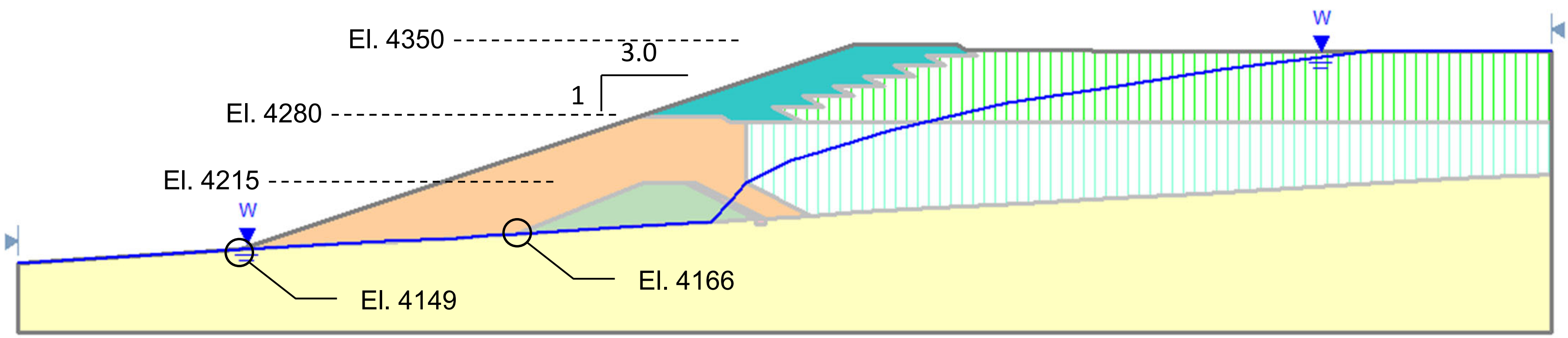
Figure 3-3

PROJECT NUMBER: 17-2021-4024

SCALE: N/A DATE: DEC 2021



Material Name	Color
Foundation Soil	
Starter Emankment	
Coarse Tailings	
Drain Rock	
Fine Tailings (Drained)	
Compacted Berm	
Whole Tailings (Drained)	

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Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2A1 Final – Geometry

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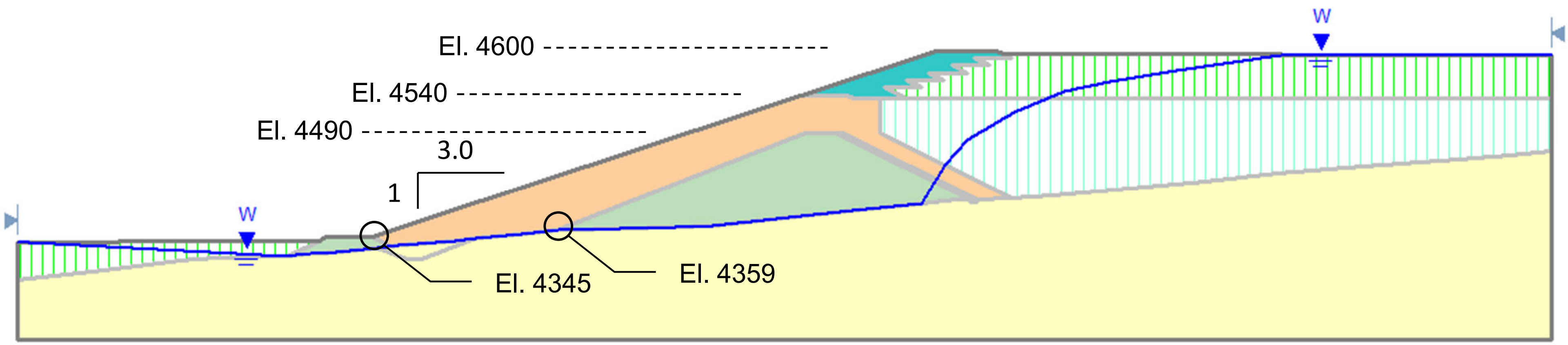
Figure 3-4

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021

RCC-CW003827



Material Name	Color
Foundation Soil	
Starter Emankment	
Coarse Tailings	
Drain Rock	
Fine Tailings (Drained)	
Compacted Berm	
Whole Tailings (Drained)	

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2A2 Final – Geometry

wood.

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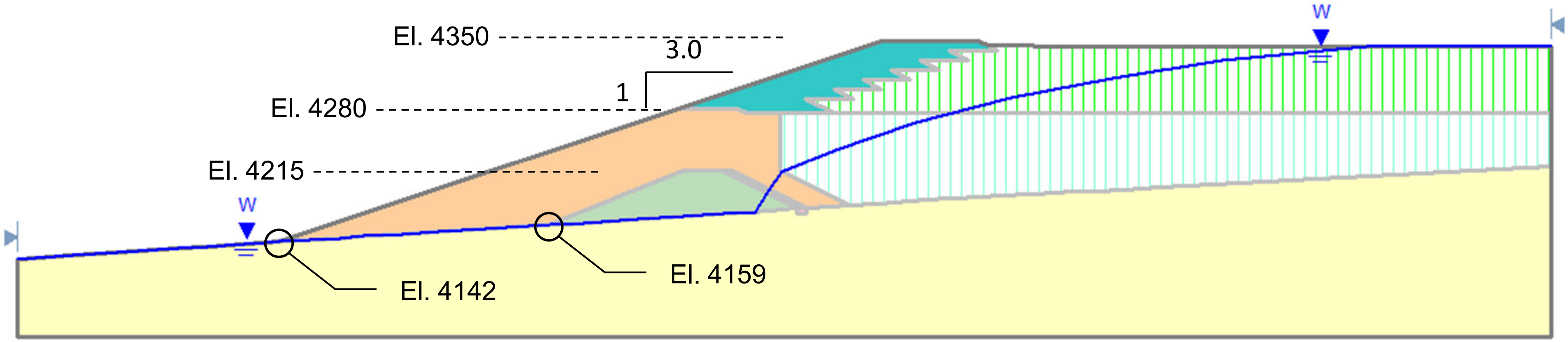
Figure 3-5

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021



Material Name	Color
Foundation Soil	
Starter Emankment	
Coarse Tailings	
Drain Rock	
Fine Tailings (Drained)	
Compacted Berm	
Whole Tailings (Drained)	

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Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2B Final – Geometry

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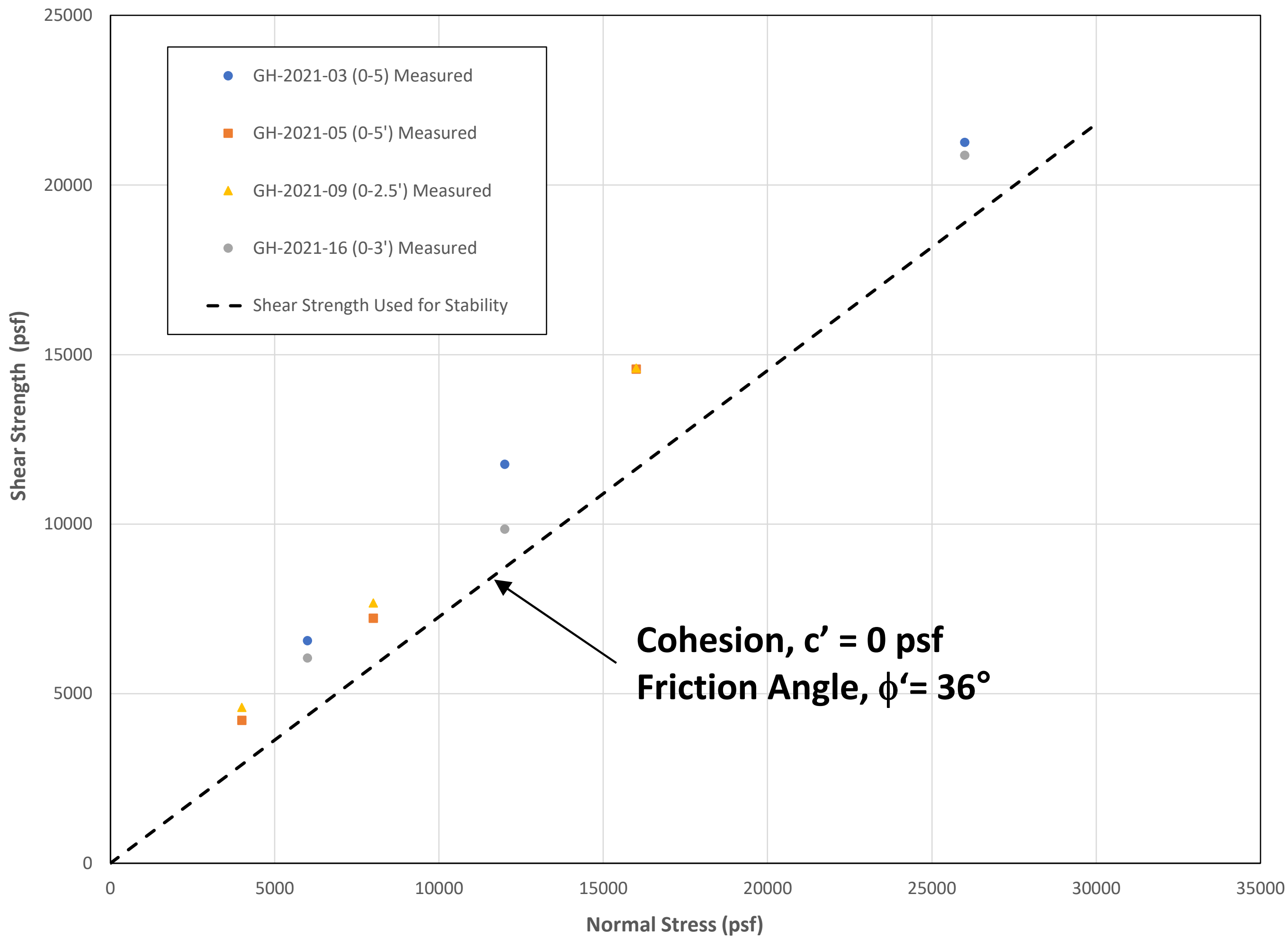
Figure 3-6

PROJECT NUMBER: 17-2021-4024

SCALE: N/A DATE: DEC 2021



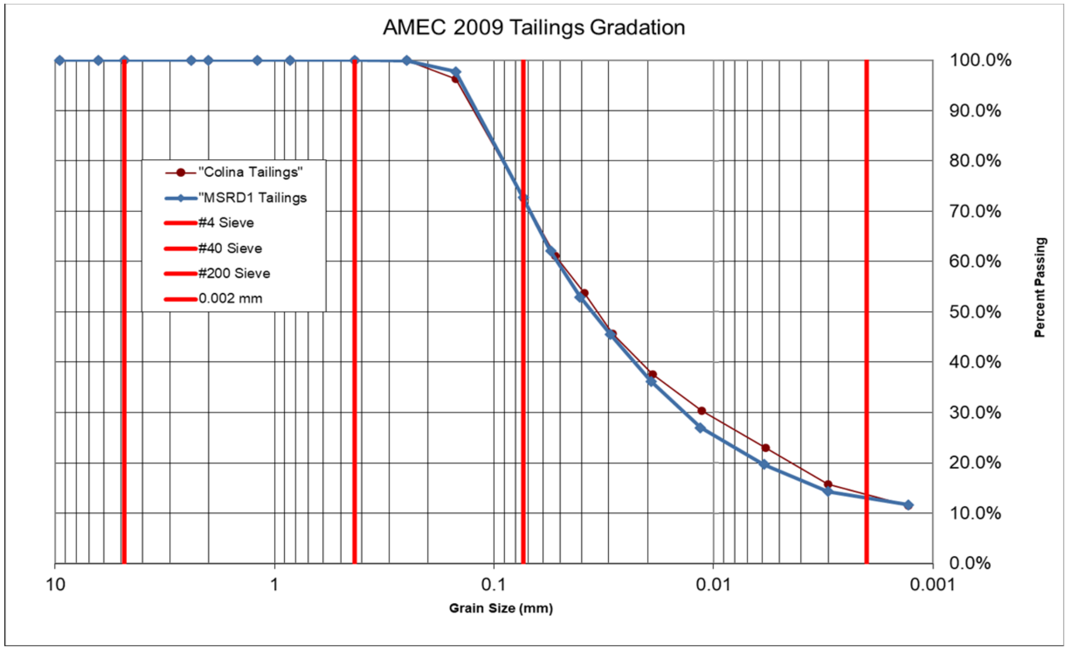
Shear Strength Used for Modeling versus Direct Shear Test Results

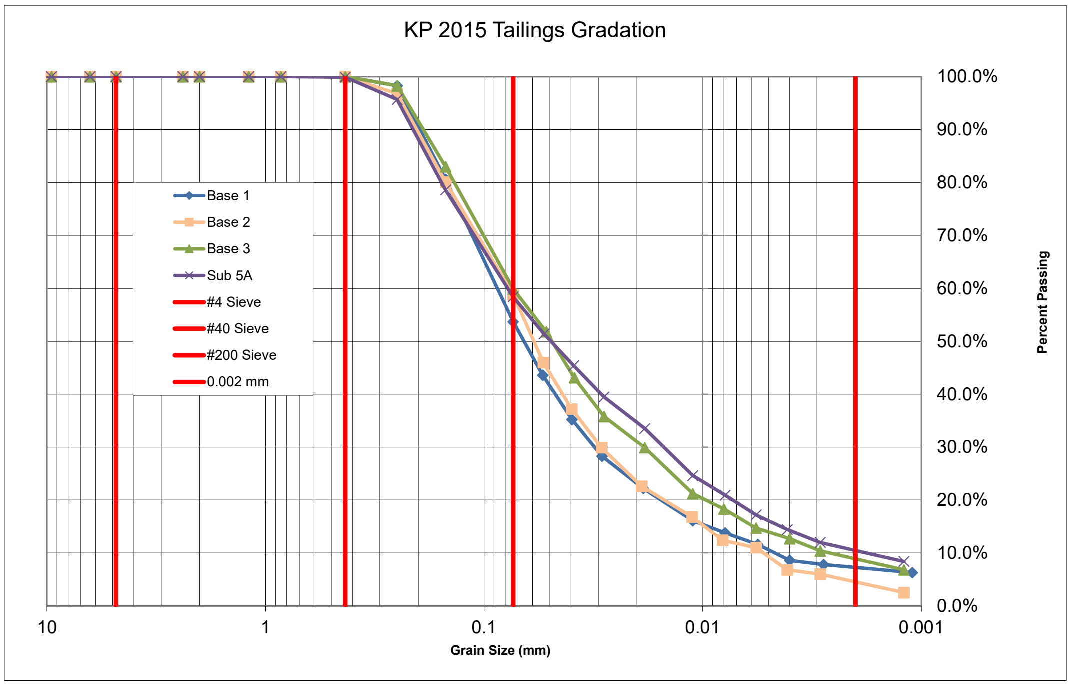
- **Foundation Soil**
- **Embankment Fill (Starter Dam)**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Summary of Direct Shear Tests on Foundation Soils

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-1			
	PROJECT NUMBER:	17-2021-4024		
	SCALE:	N/A	DATE:	DEC 2021





Atterberg Limits and Specific Gravity of Whole Tailings (AMEC, 2009)

Sample	PL	LL	PI	SG
Colina	20	22	2	2.91
MSRD1	20	21	1	3.01

Atterberg Limits and Specific Gravity of Whole Tailings (KP, 2015)

Sample	PL	LL	PI	SG
Base 1	17	18	1	3.01
Base 2	18	22	4	2.94
Base 3	17	21	4	2.93
Sub 5A	17	24	7	2.88

Refer to the Memo for list of references.

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Summary of Index Testing on Rosemont Tailings

wood.

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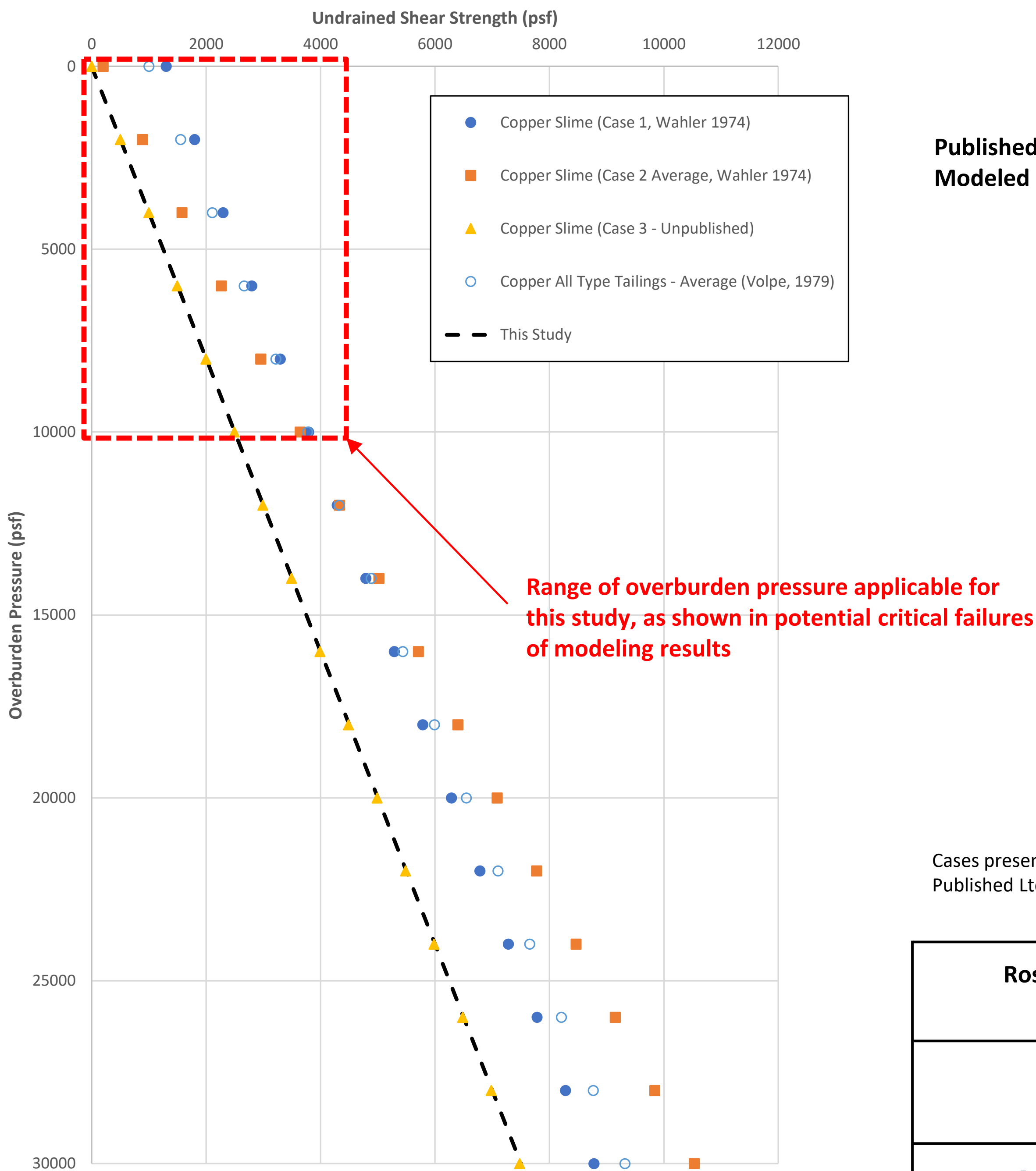
Figure 4-2	
PROJECT NUMBER:	17-2021-4024
SCALE: N/A	DATE: DEC 2021

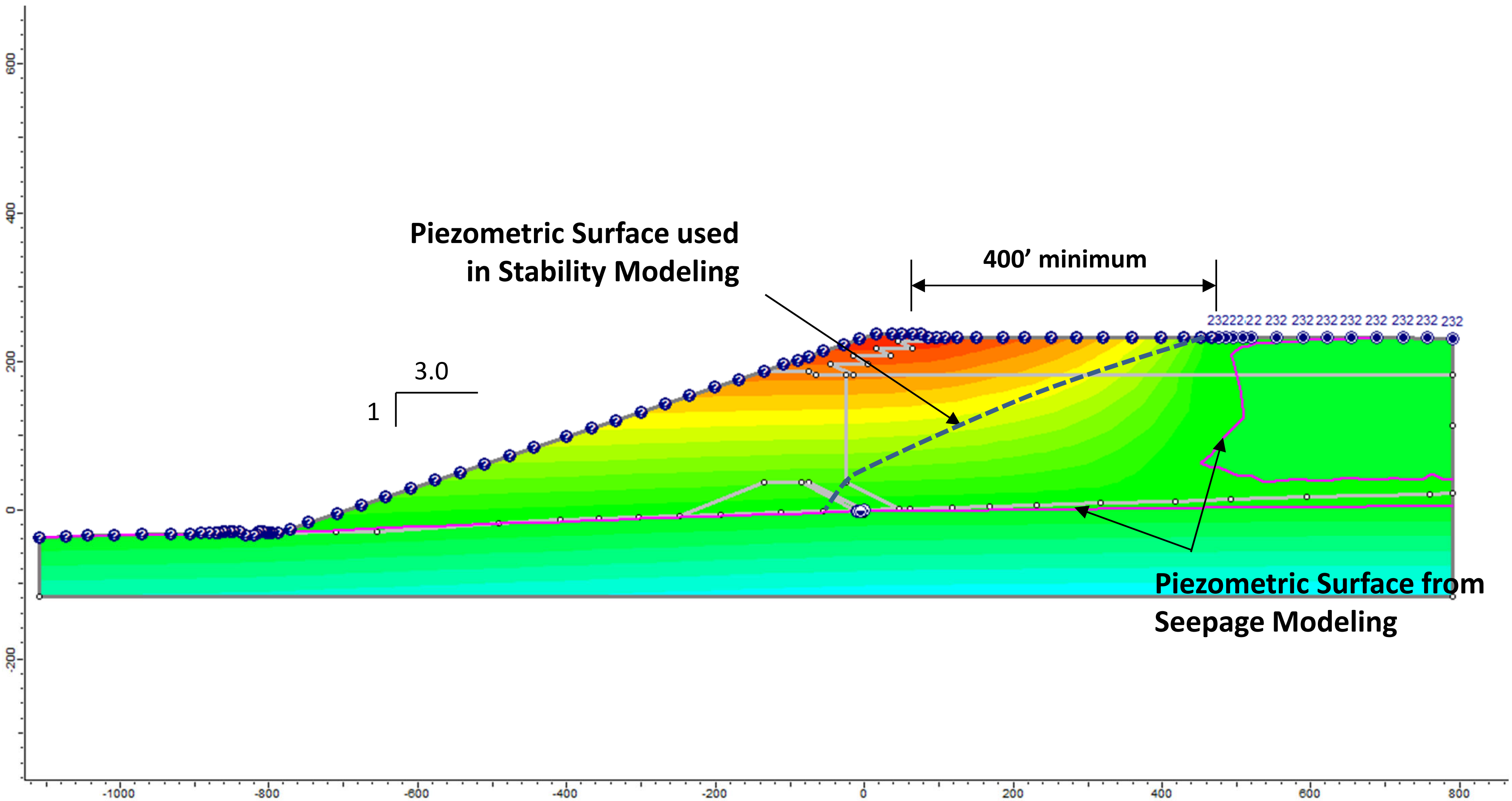


Published Tailings Undrained Shear Strength in Vick (1990) versus Modeled Undrained Shear Strength for this Study

Cases presented in Vick, S.G, Planning, Design, and Analysis of Tailings Dam, BiTech Published Ltd, Vancouver, B.C, Canada, 1990.

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses		
Tailings Undrained Shear Strength			
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-3		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE: DEC 2021	

RCC-CW003832

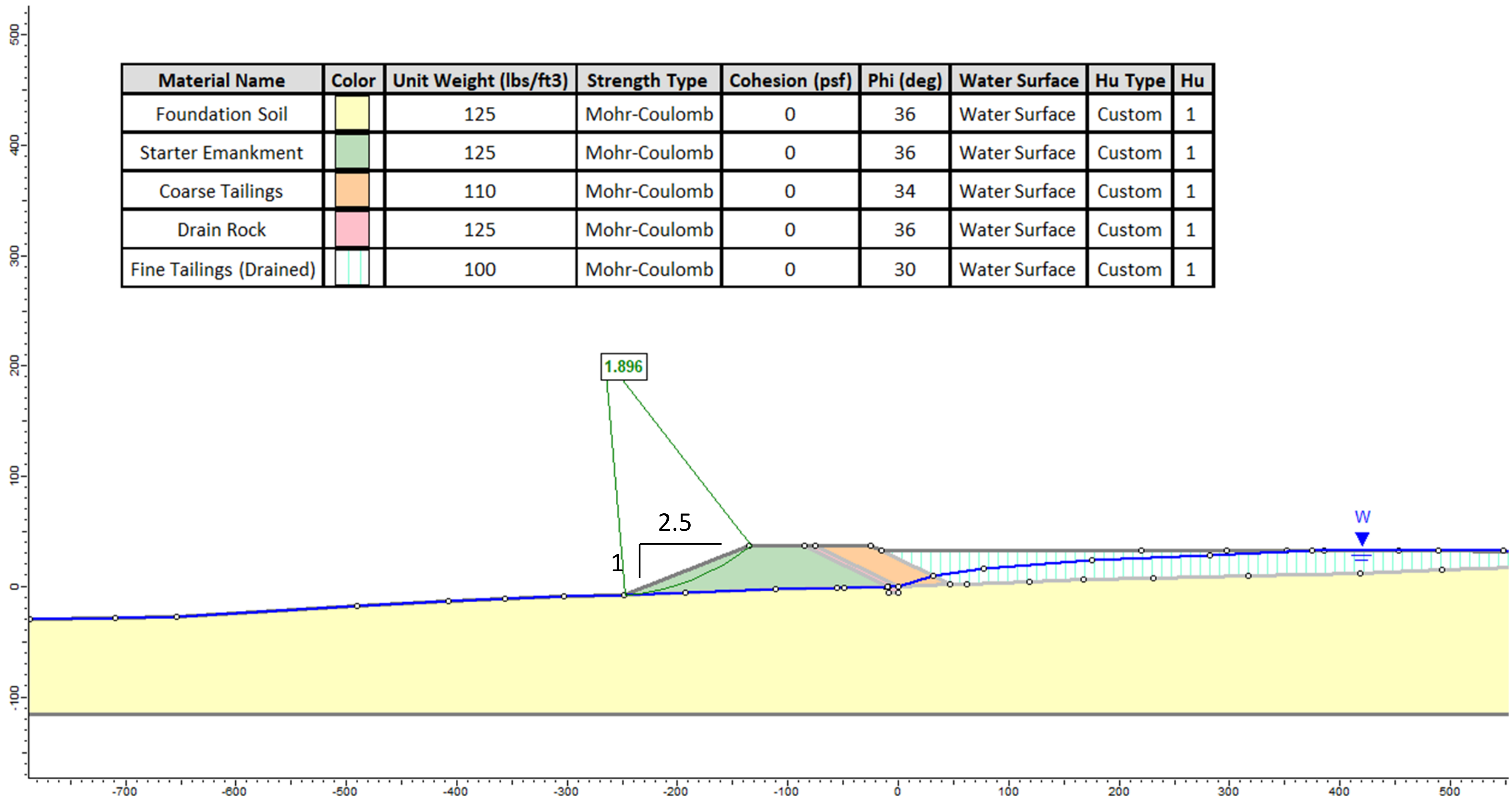


Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF’s Stability Analyses

Section TSF-1A Final – Seepage

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-4	
	PROJECT NUMBER: 17-2021-4024	
	SCALE: N/A	DATE: DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1



Section TSF-1A Starter Dam

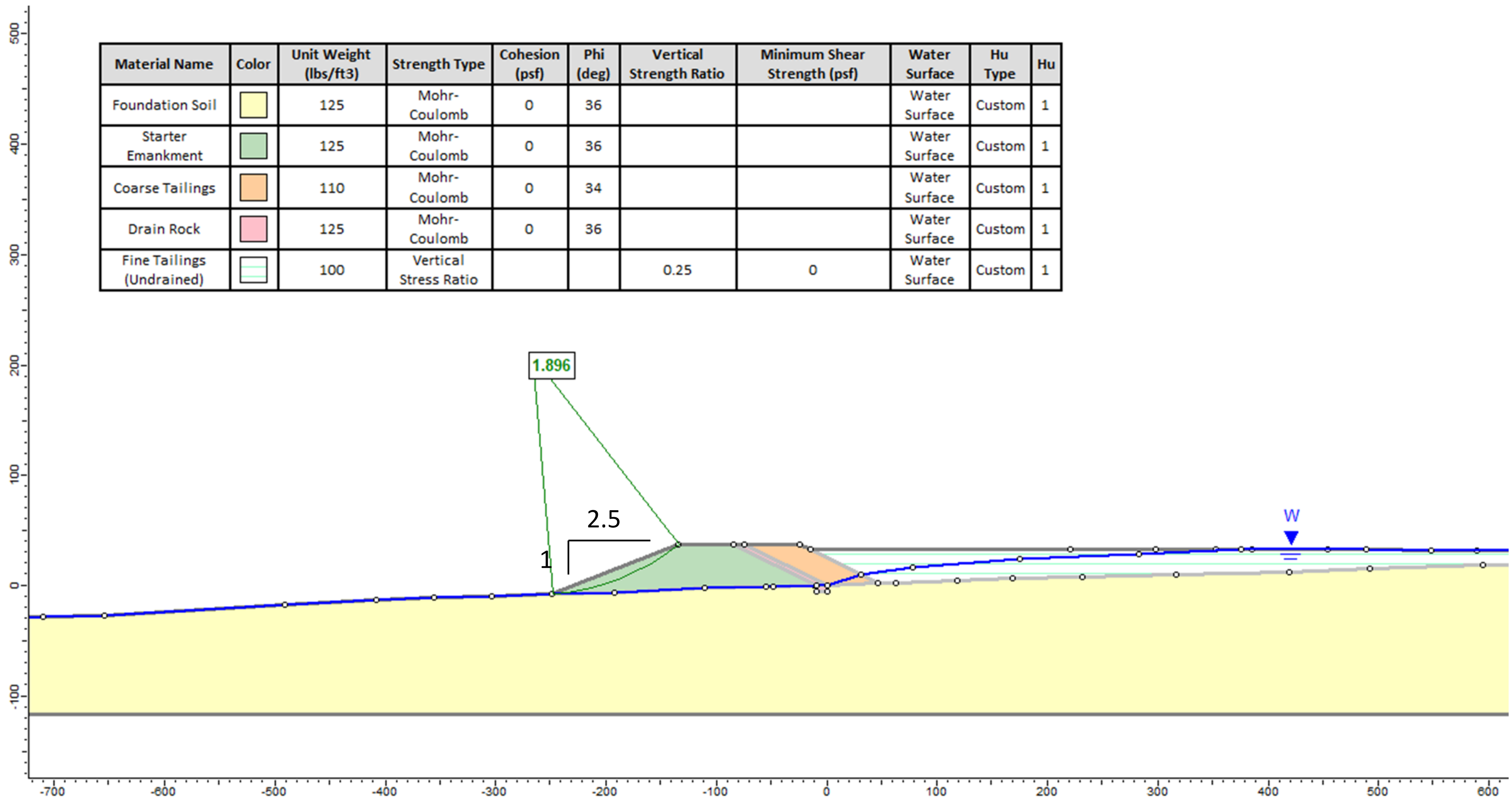
- **Static Drained Conditions**
- **Min. FOS = 1.90**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-1A Starter Dam – Static Conditions

wood. Wood Environment & Infrastructure Solutions, Inc.	Figure 4-5		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1



Section TSF-1A Starter Dam

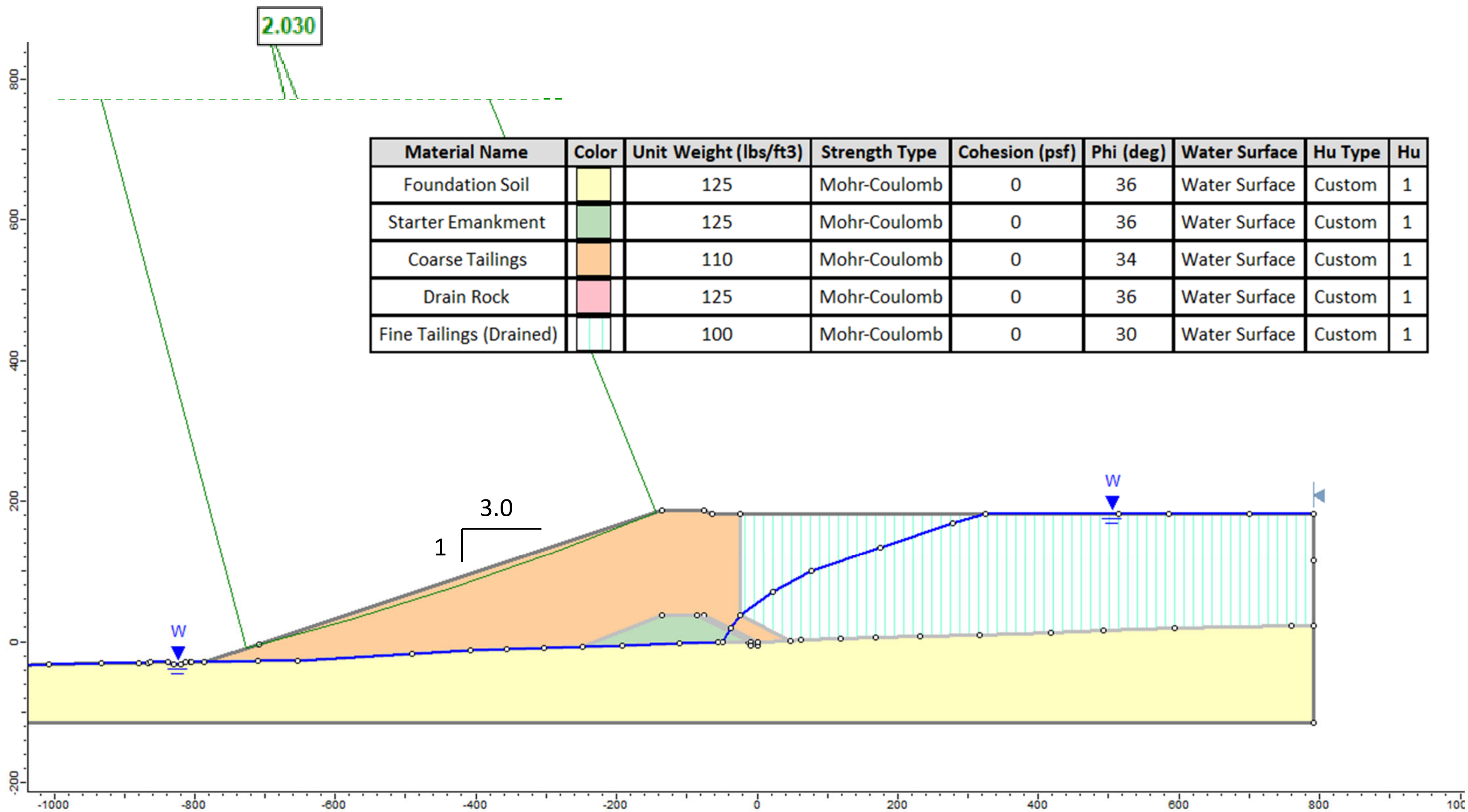
- **Static Undrained Conditions**
- **Min. FOS = 1.90**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-1A Starter Dam – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-6			
	PROJECT NUMBER:	17-2021-4024		
	SCALE:	N/A	DATE:	DEC 2021

RCC-CW003835



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-1A Centerline Raise

- **Static Drained Conditions**
- **Min. FOS = 2.03**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

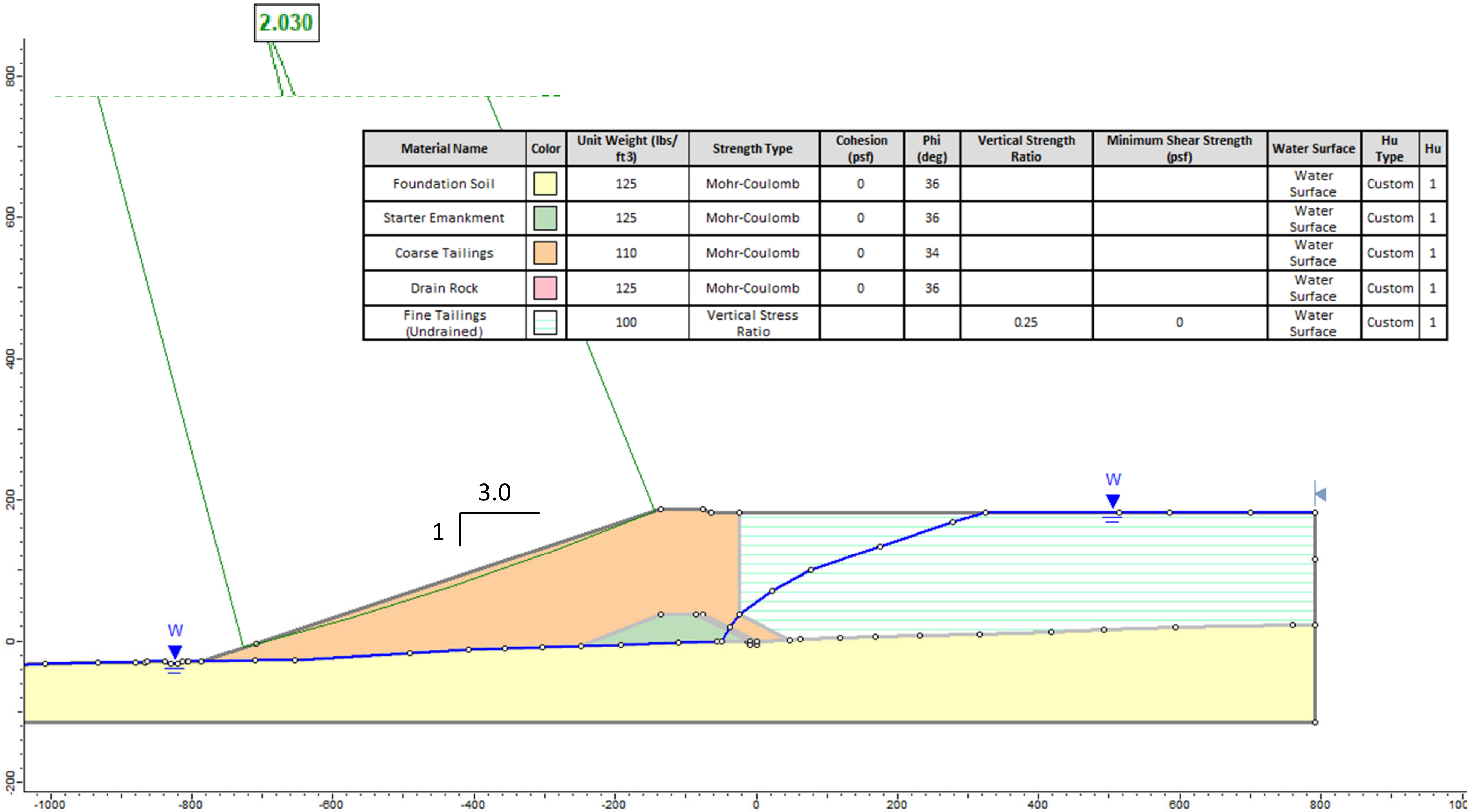
Section TSF-1A Centerline Raise – Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

Figure 4-7

PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-1A Centerline Raise

- **Static Undrained Conditions**
- **Min. FOS = 2.03**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

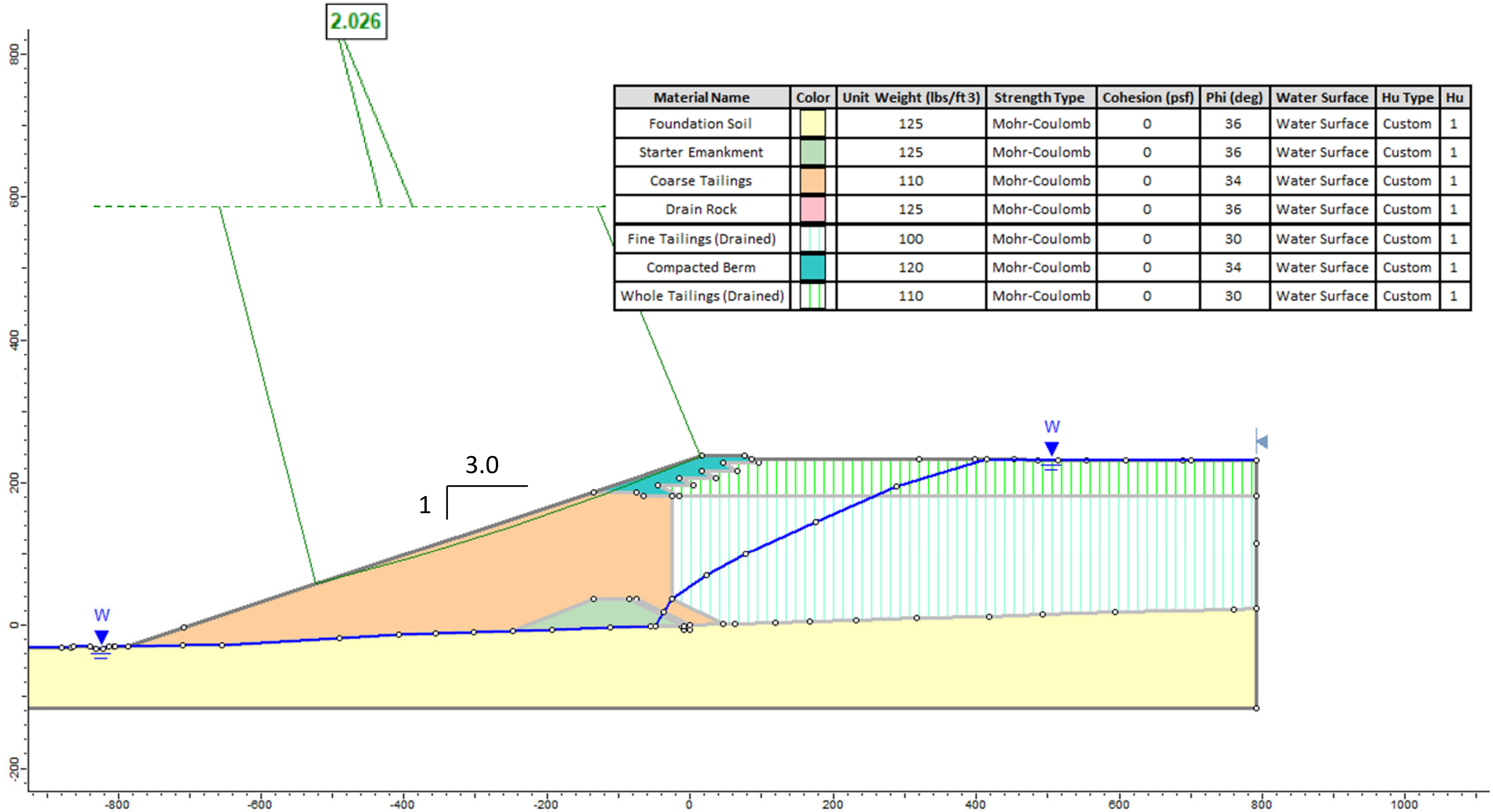
Section TSF-1A Centerline Raise – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-8

PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021

RCC-CW003837



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34	Water Surface	Custom	1
Whole Tailings (Drained)		110	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-1A Final Configuration

- **Static Drained Conditions**
- **Min. FOS = 2.03**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-1A Final – Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

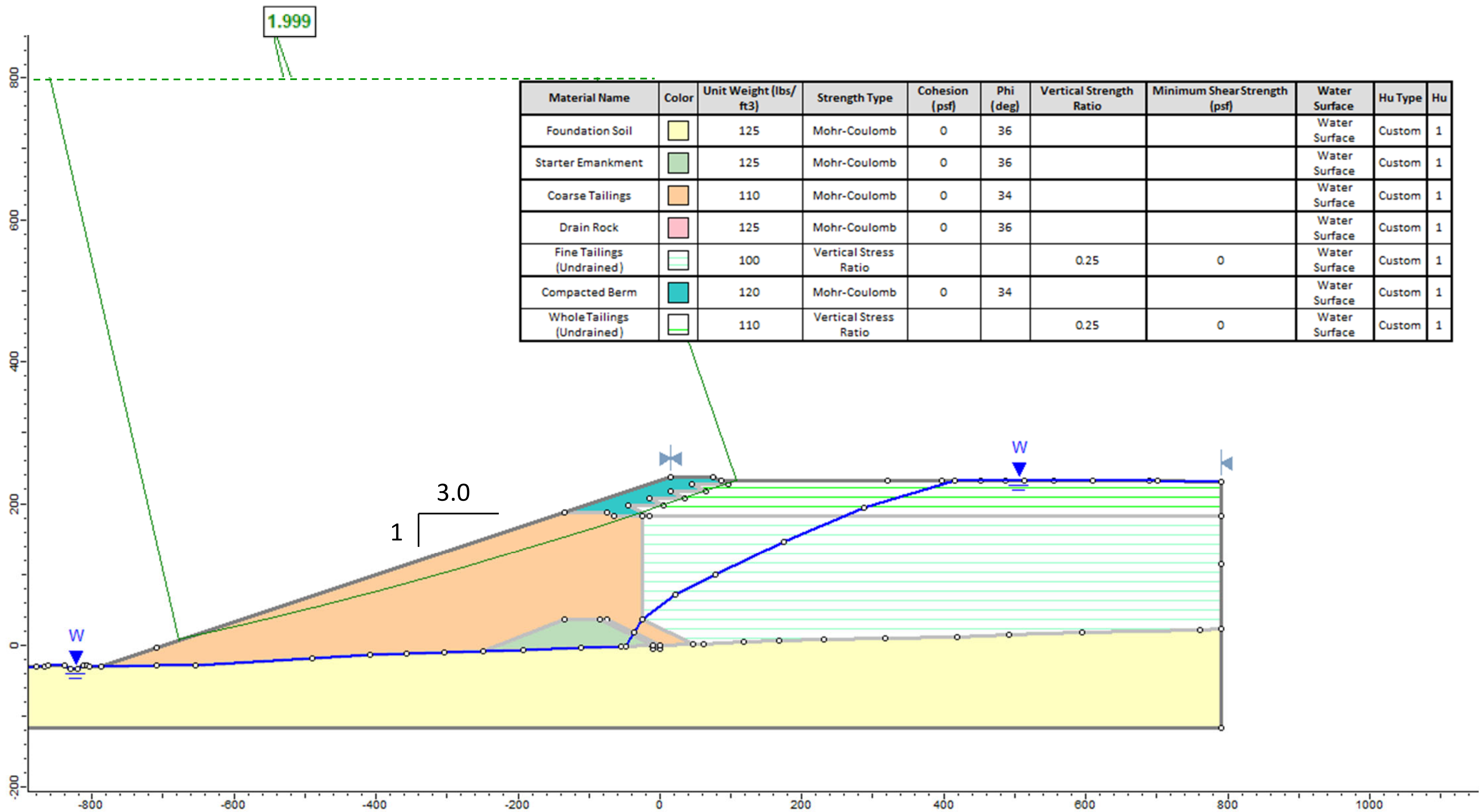
Figure 4-9

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021

RCC-CW003838



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained)		110	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-1A Final Configuration

- **Static Undrained Conditions**
- **Min. FOS = 2.00**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-1A Final – Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

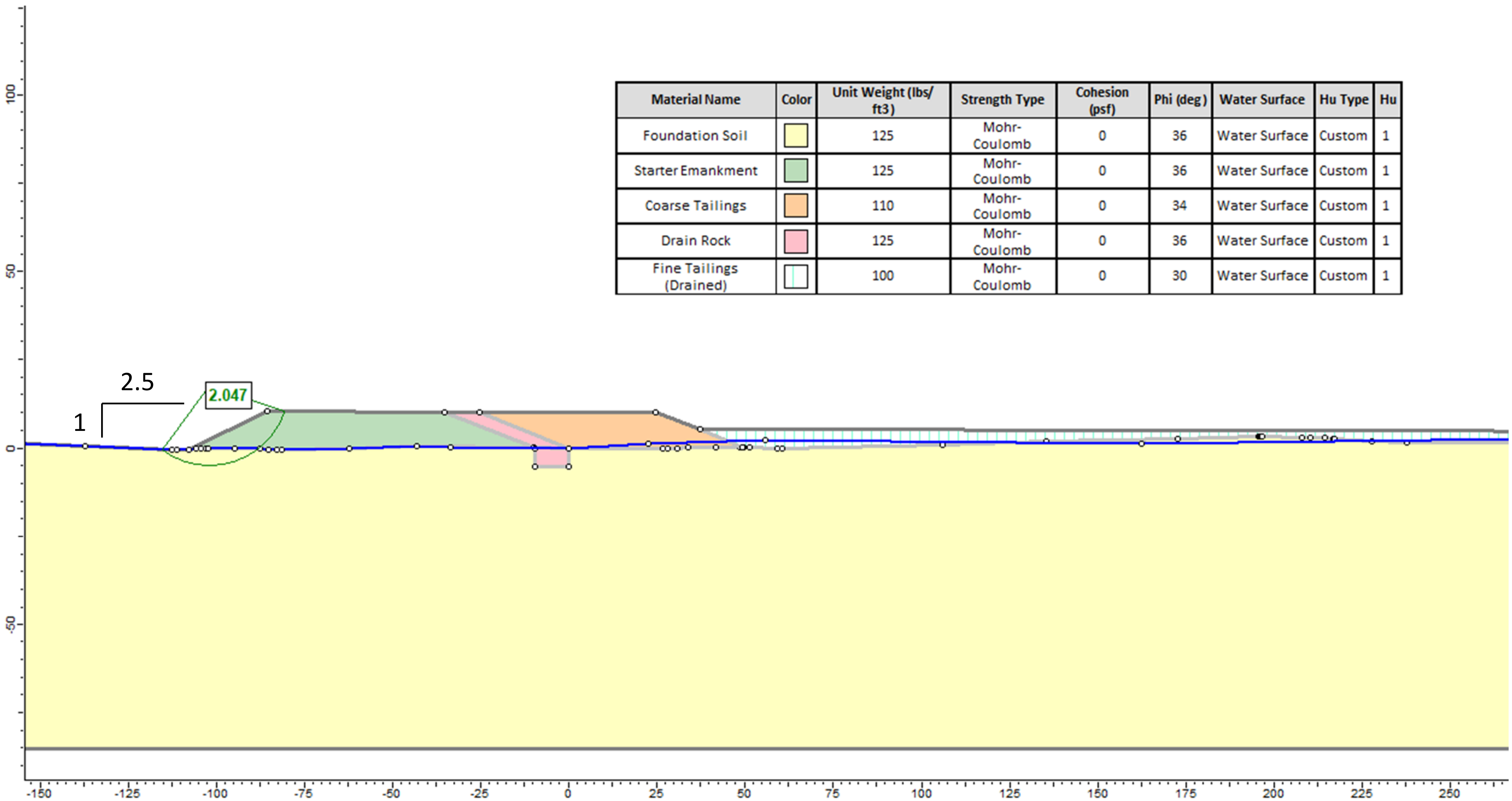
Figure 4-10

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021

RCC-CW003839



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-1B Starter Dam

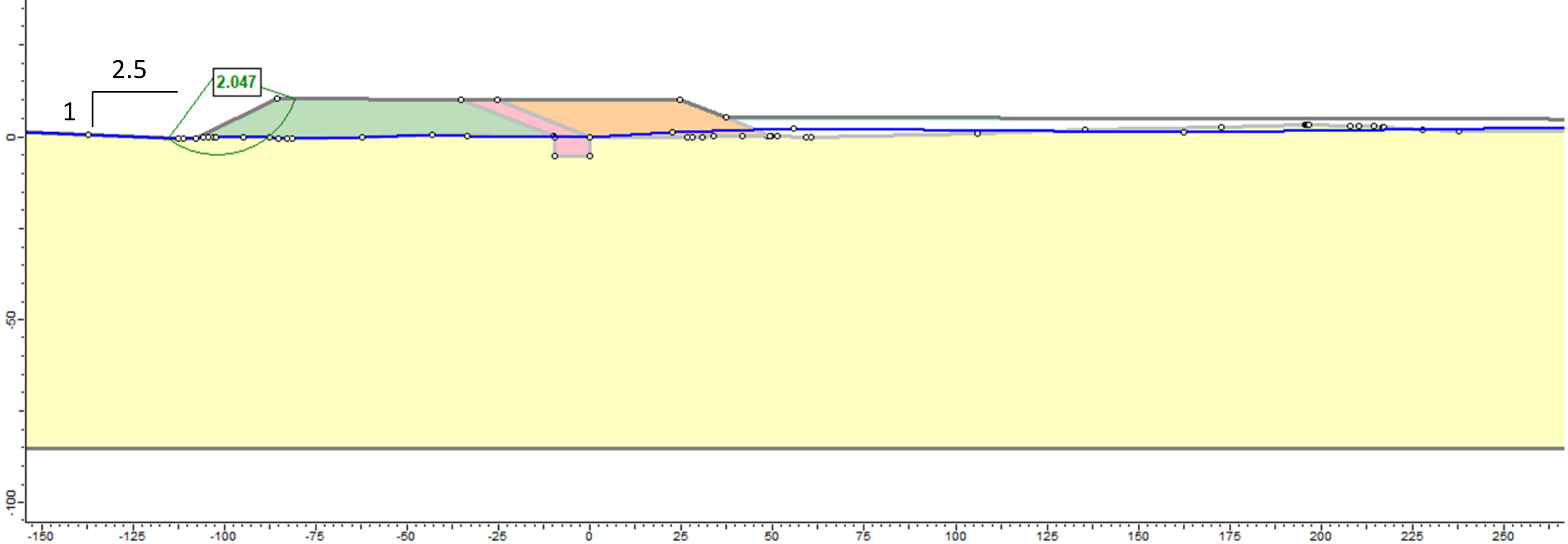
- **Static Drained Conditions**
- **Min. FOS = 2.05**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-1B Starter Dam – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-11		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1



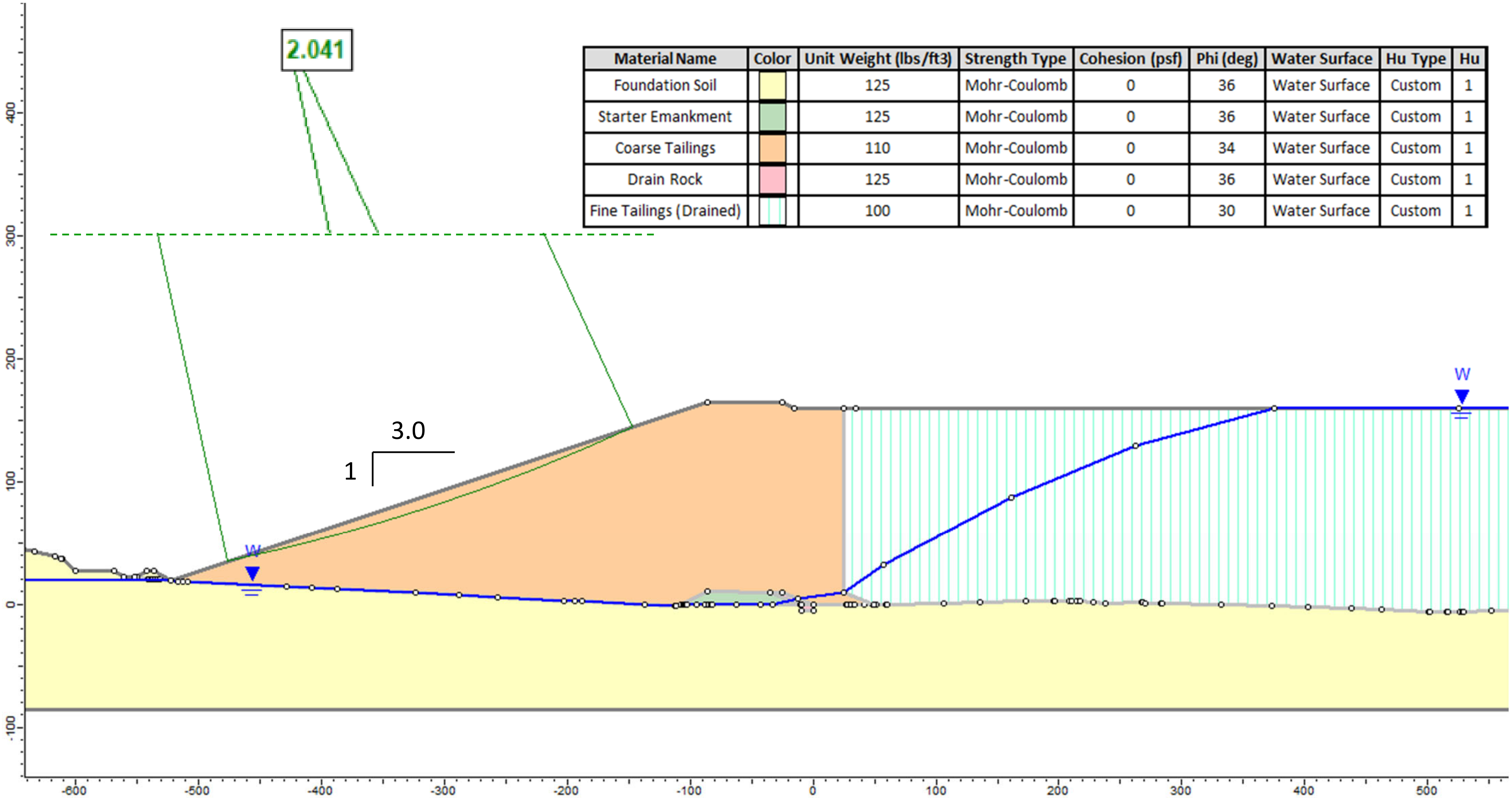
Section TSF-1B Starter Dam
- **Static Undrained Conditions**
- **Min. FOS = 2.05**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-1B Starter Dam – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-12			
	PROJECT NUMBER:	17-2021-4024		
	SCALE:	N/A	DATE:	DEC 2021

RCC-CW003841

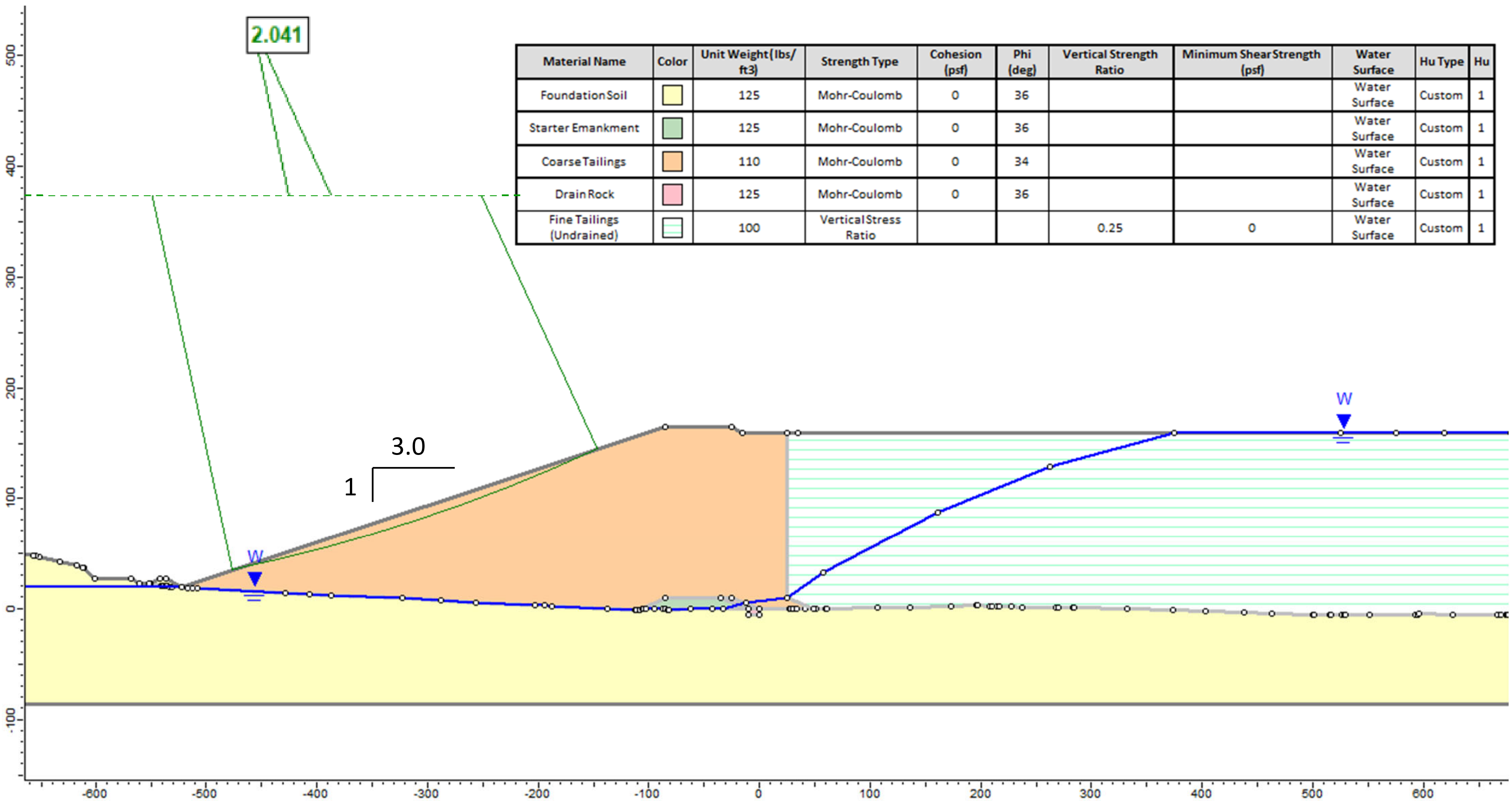


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-1B Centerline Raise

- **Static Drained Conditions**
- **Min. FOS = 2.04**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-1B Centerline Raise – Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-13 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-1B Centerline Raise

- **Static Undrained Conditions**
- **Min. FOS = 2.04**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-1B Centerline Raise – Static Conditions

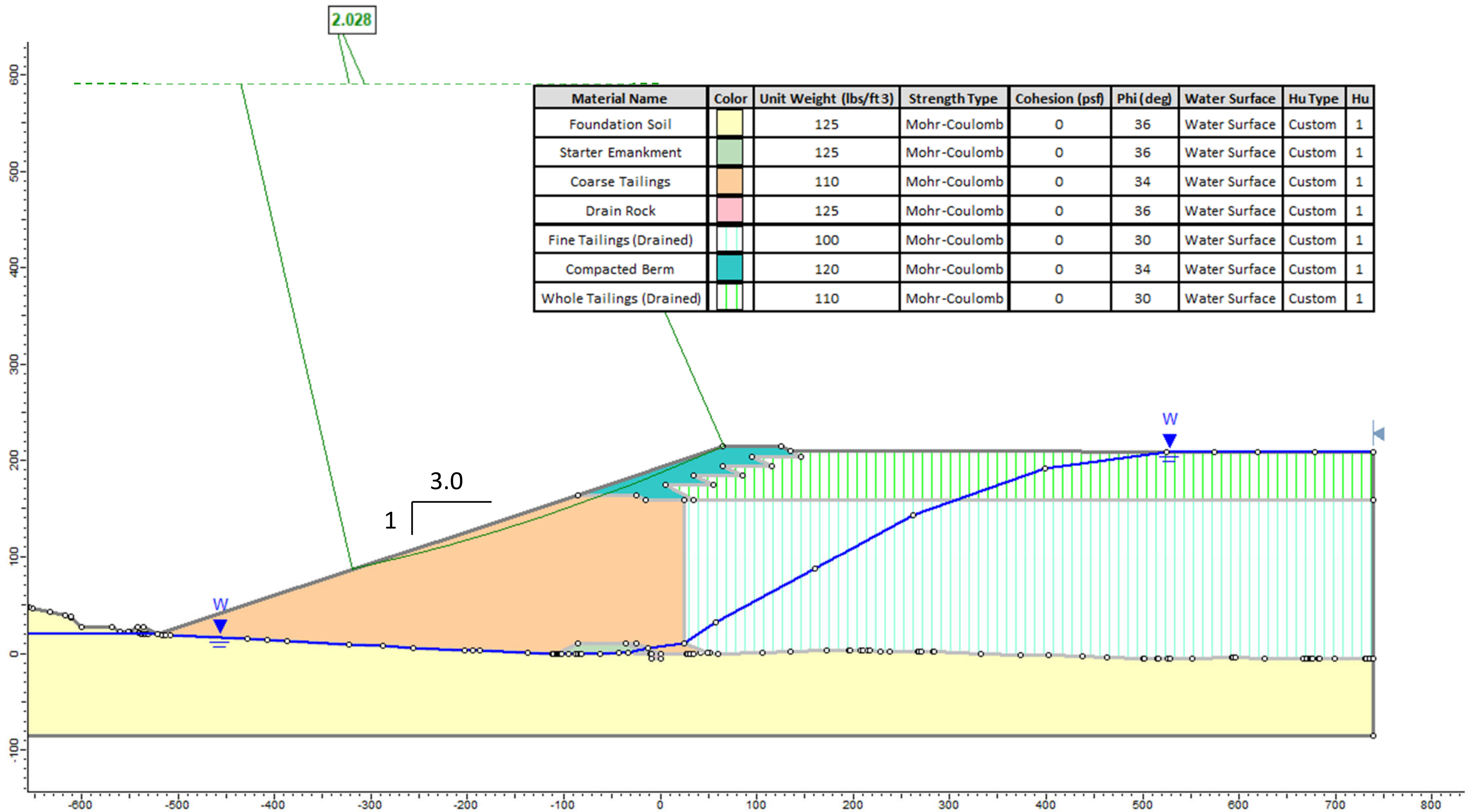
wood.

Wood Environment & Infrastructure Solutions, Inc.

Figure 4-14

PROJECT NUMBER: 17-2021-4024

SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34	Water Surface	Custom	1
Whole Tailings (Drained)		110	Mohr-Coulomb	0	30	Water Surface	Custom	1

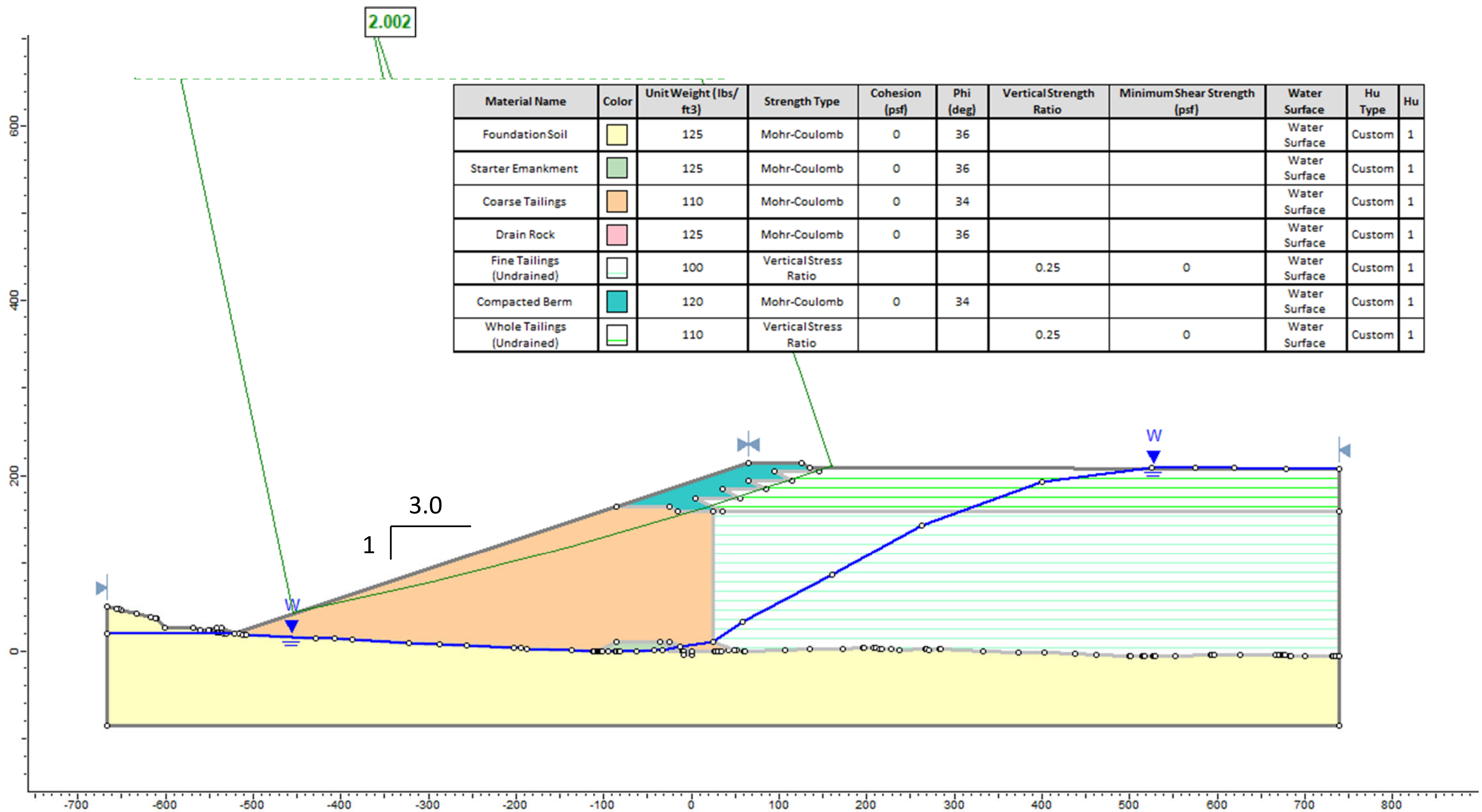
Section TSF-1B Final Configuration

- **Static Drained Conditions**
- **Min. FOS = 2.03**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-1B Final – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-15			
	PROJECT NUMBER:	17-2021-4024		
	SCALE:	N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained)		110	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-1B Final Configuration
- **Static Undrained Conditions**
- **Min. FOS = 2.00**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-1B Final – Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

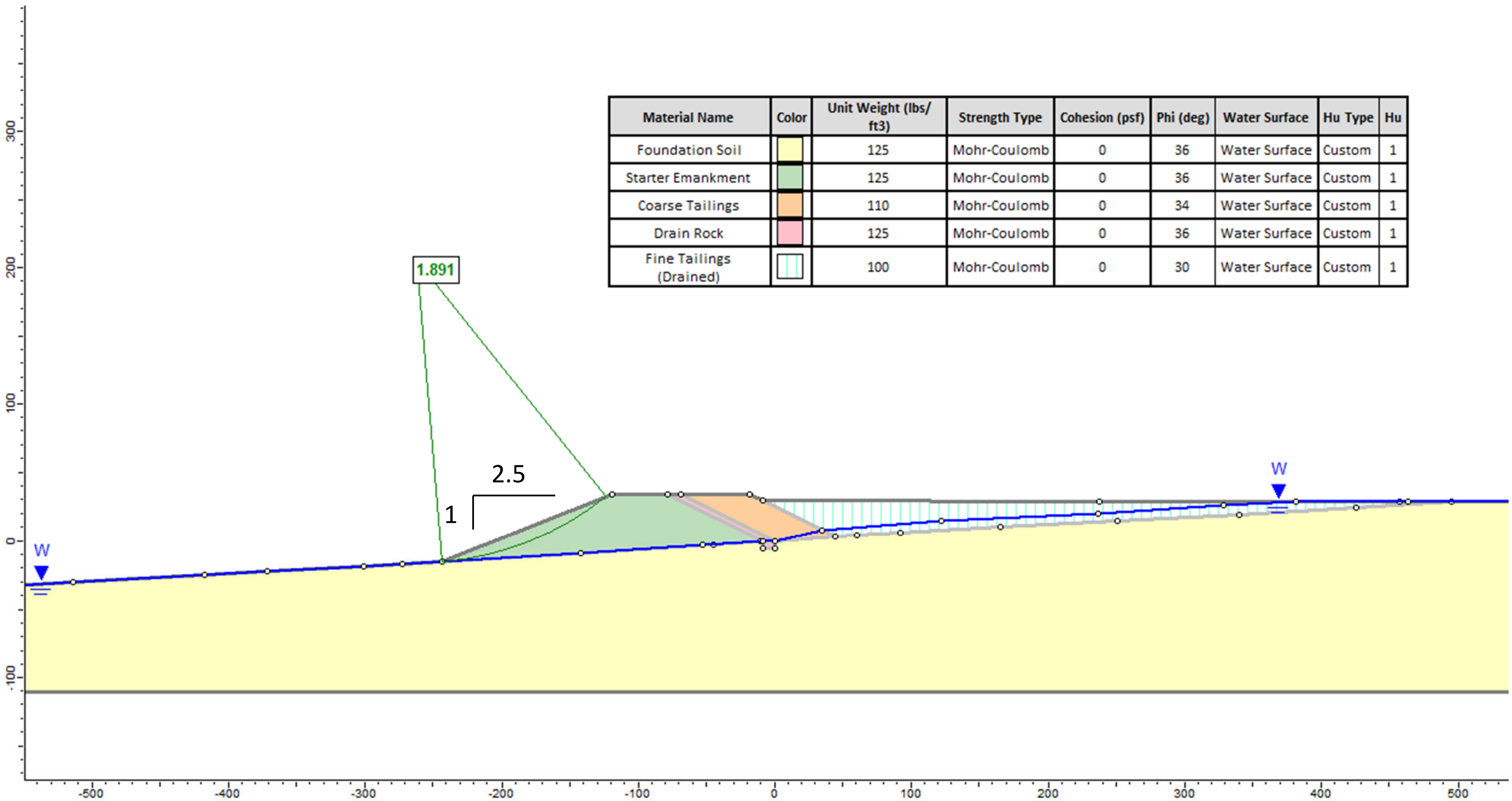
Figure 4-16

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021

RCC-CW003845



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2A1 Starter Dam
- **Static Drained Conditions**
- **Min. FOS = 1.89**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2A1 Starter Dam – Static Conditions

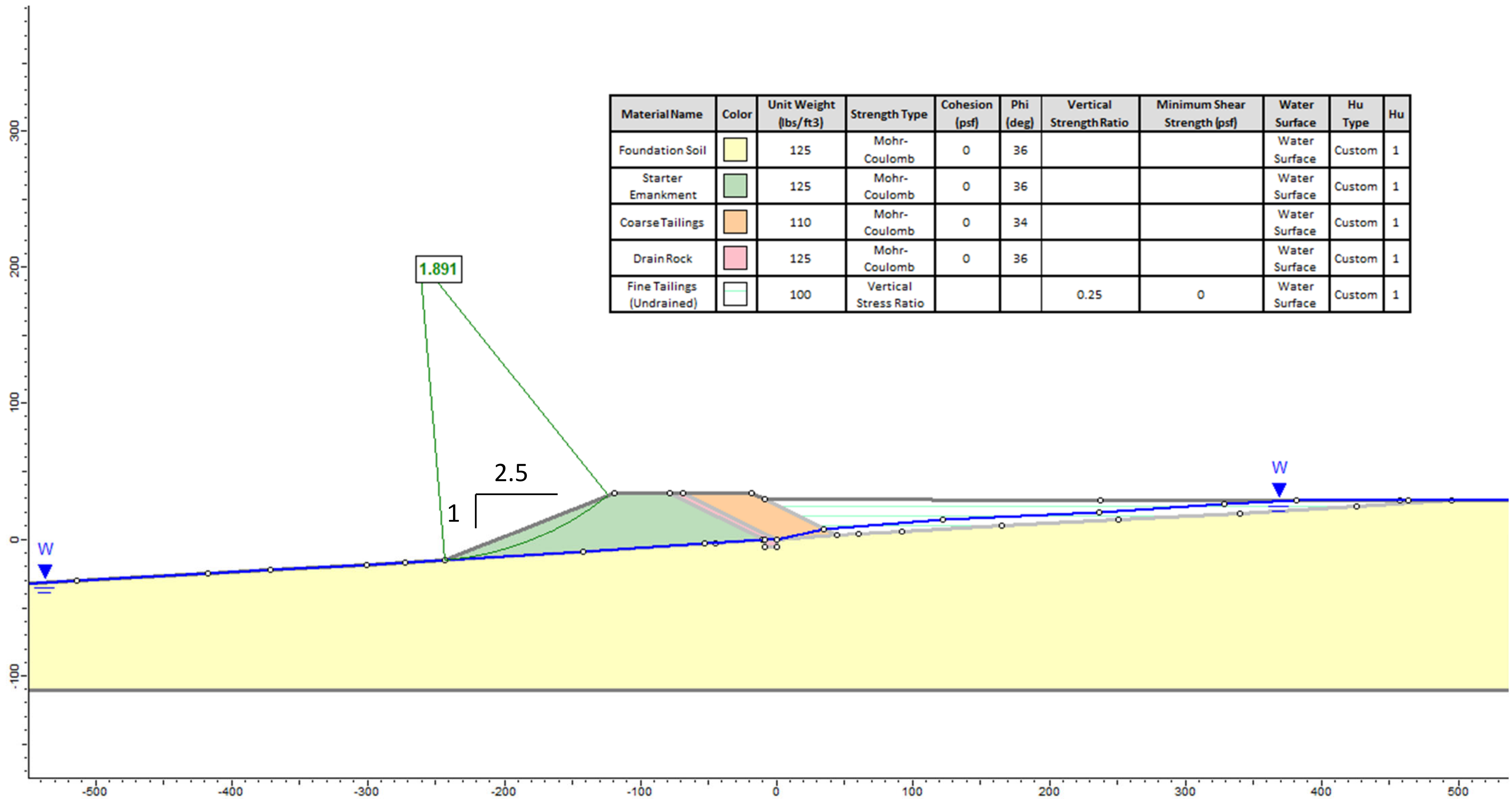
wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-17

PROJECT NUMBER: 17-2021-4024

SCALE: N/A DATE: DEC 2021

RCC-CW003846



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-2A1 Starter Dam

- **Static Undrained Conditions**
- **Min. FOS = 1.89**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2A1 Starter Dam – Static Conditions

wood.

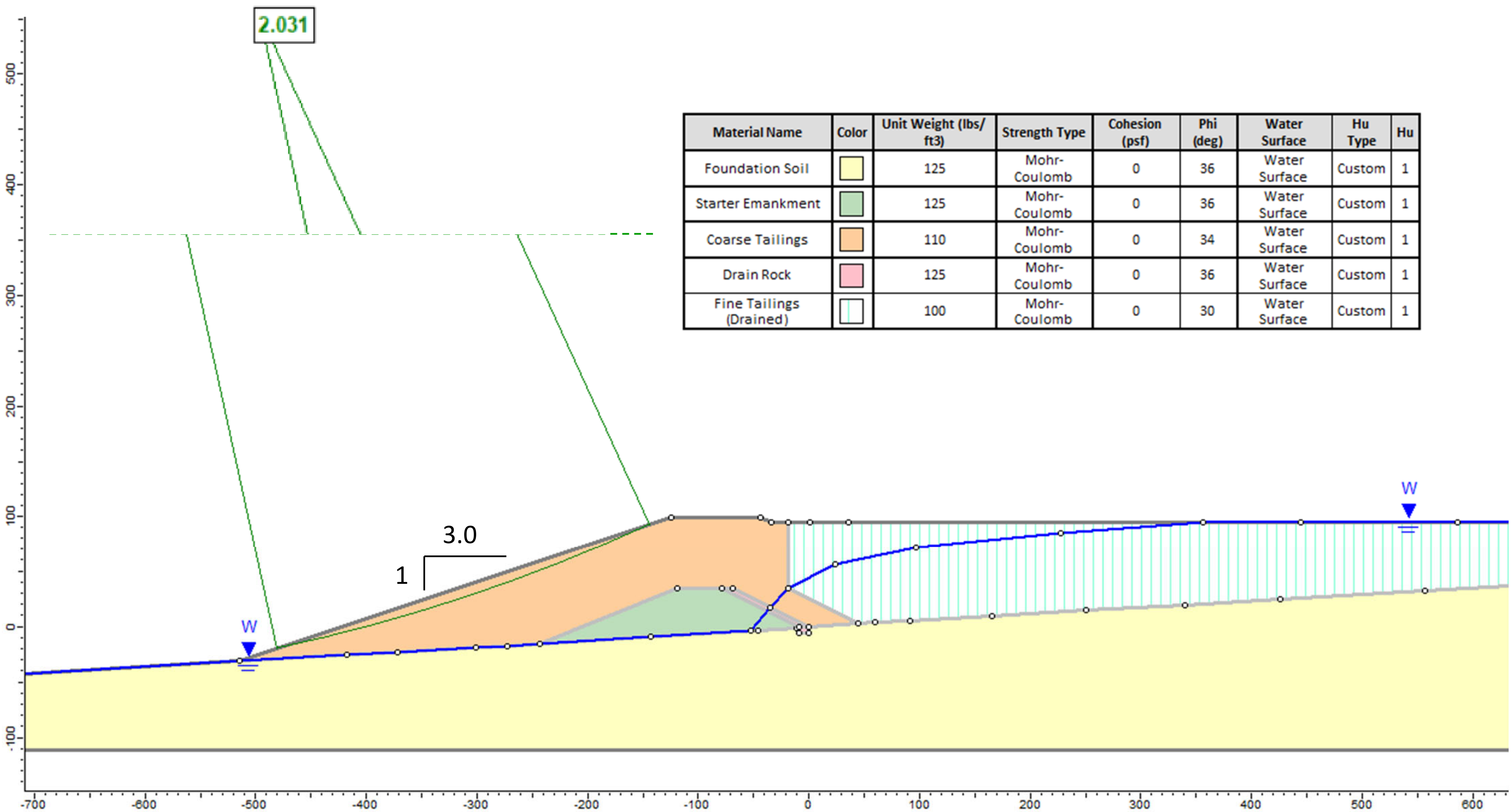
Wood Environment & Infrastructure Solutions, Inc.

Figure 4-18

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2A1 Centerline Raise

- **Static Drained Conditions**
- **Min. FOS = 2.03**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

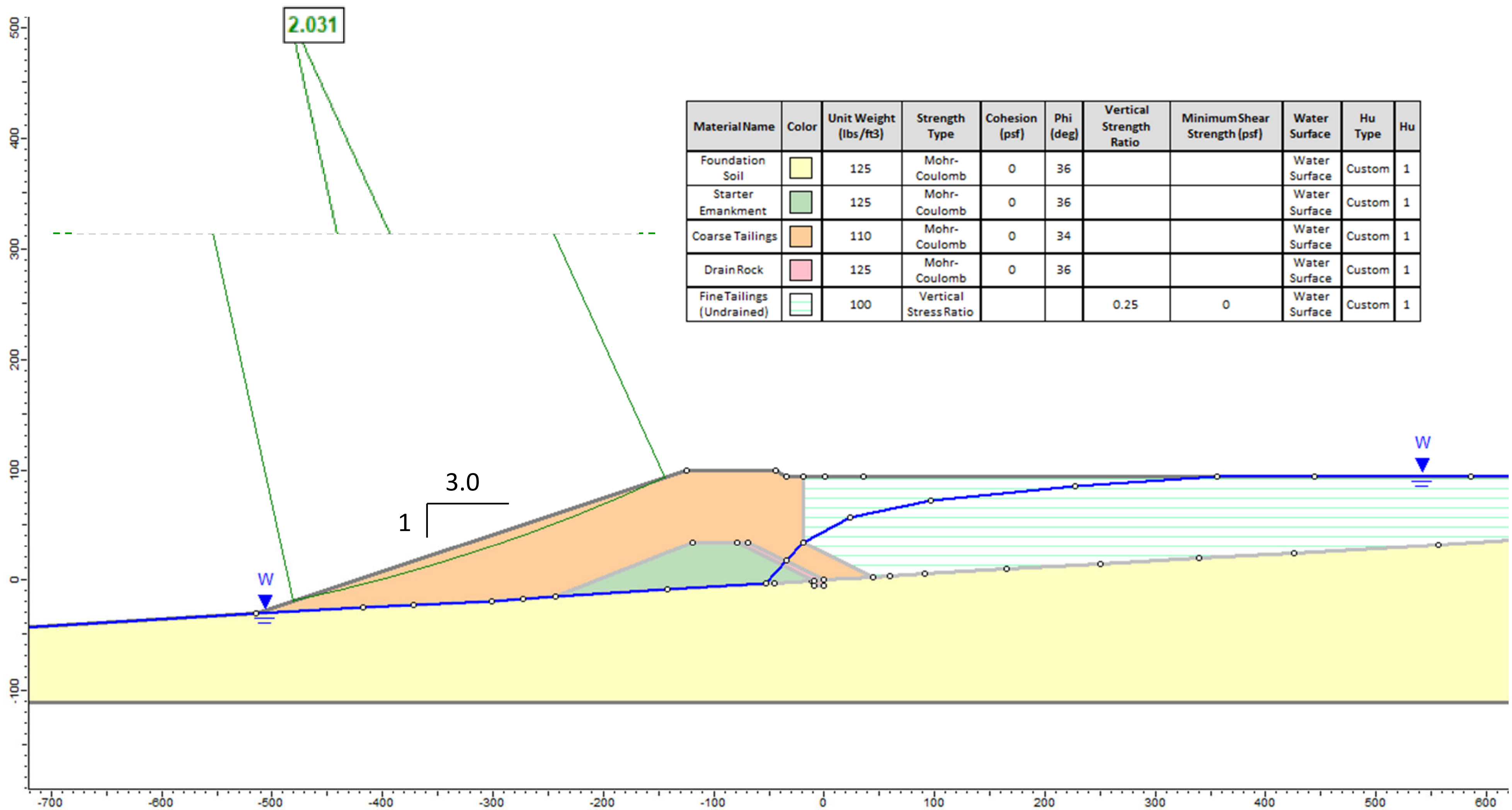
Section TSF-2A1 Centerline Raise – Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

Figure 4-19

PROJECT NUMBER:	17-2021-4024
SCALE: N/A	DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-2A1 Centerline Raise

- **Static Undrained Conditions**
- **Min. FOS = 2.03**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2A1 Centerline Raise – Static Conditions

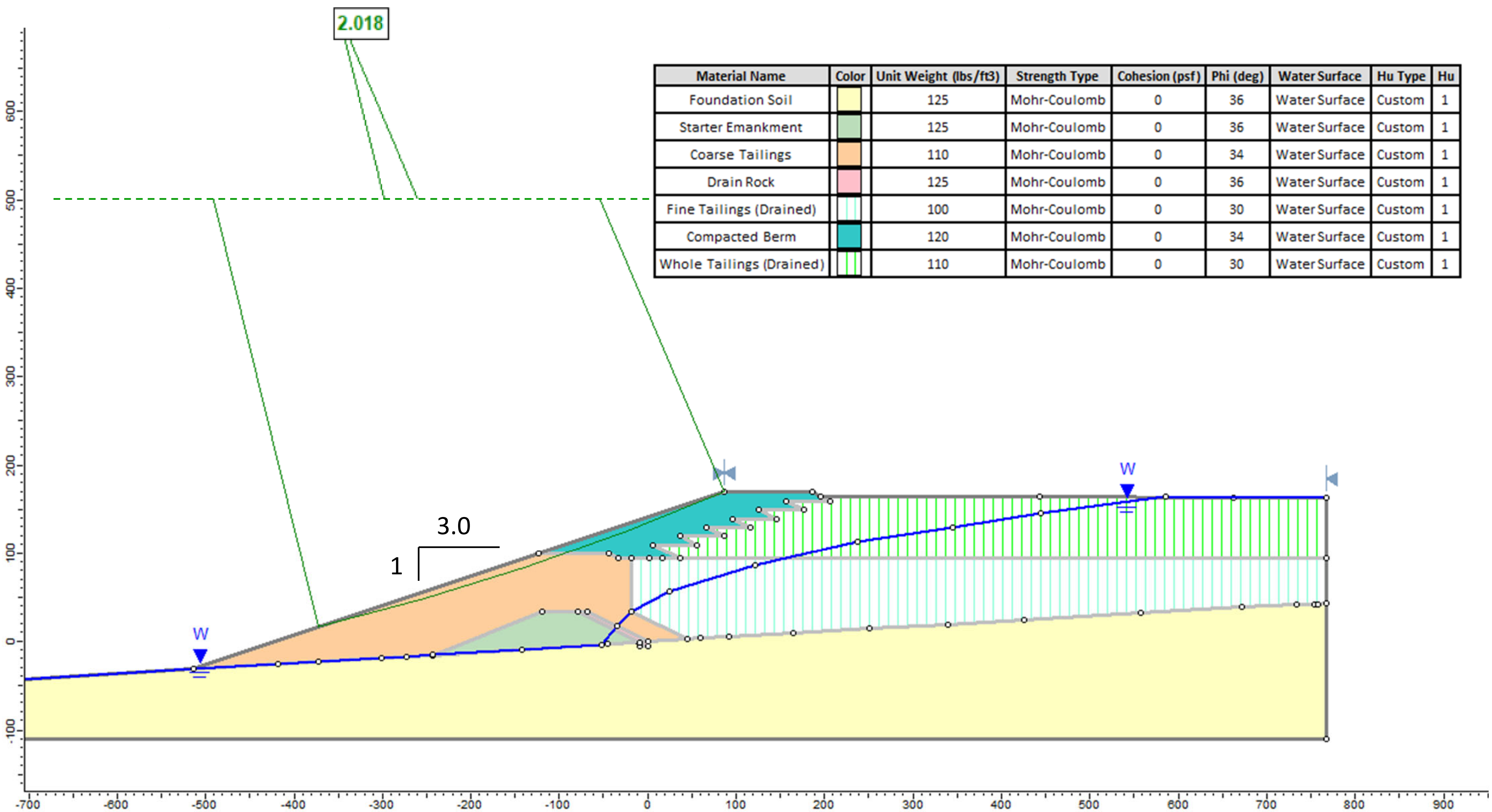
Wood Environment & Infrastructure Solutions, Inc.

Figure 4-20

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34	Water Surface	Custom	1
Whole Tailings (Drained)		110	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2A1 Final Configuration

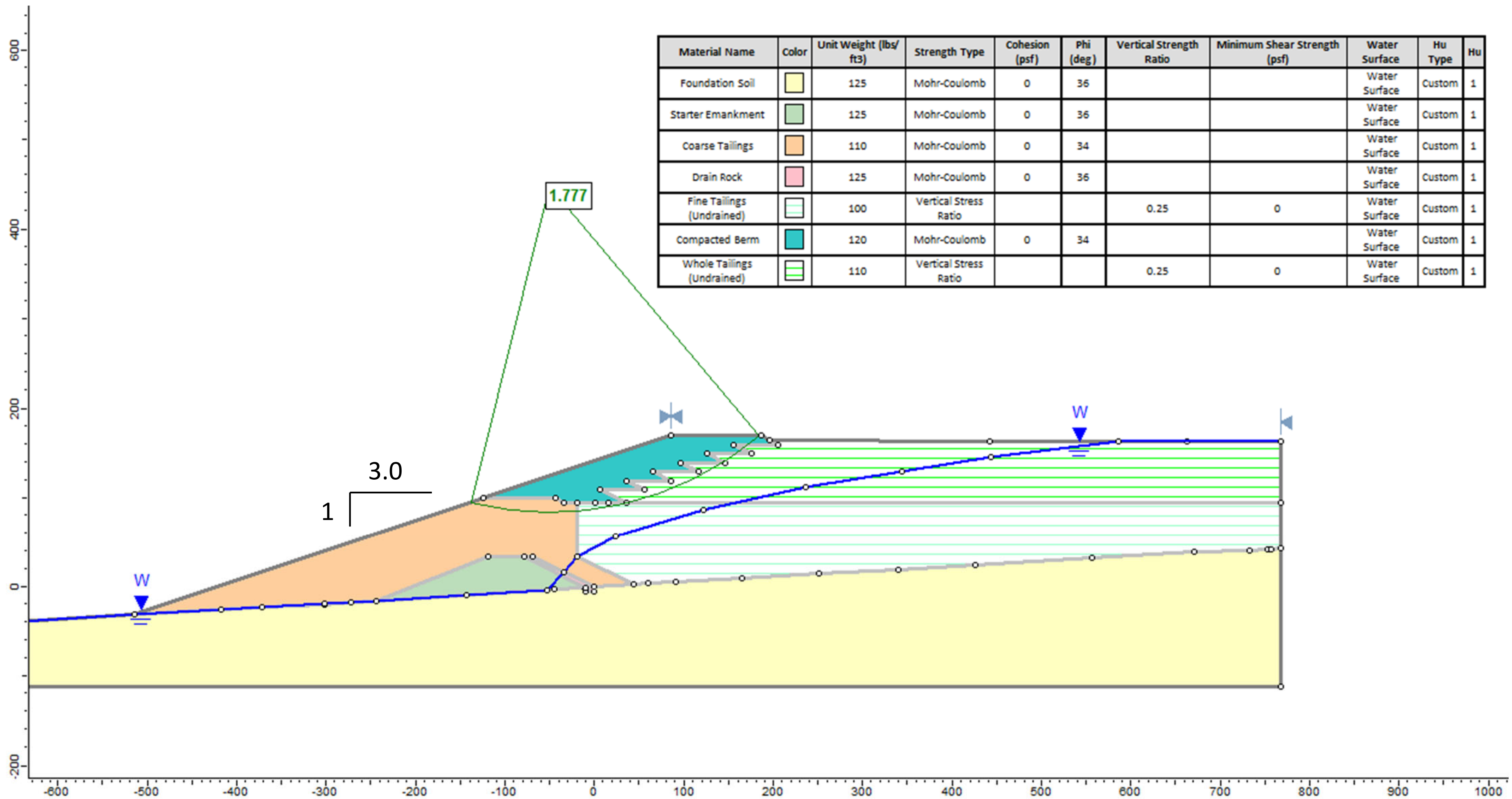
- **Static Drained Conditions**
- **Min. FOS = 2.02**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A1 Final – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-21			
PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained)		110	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

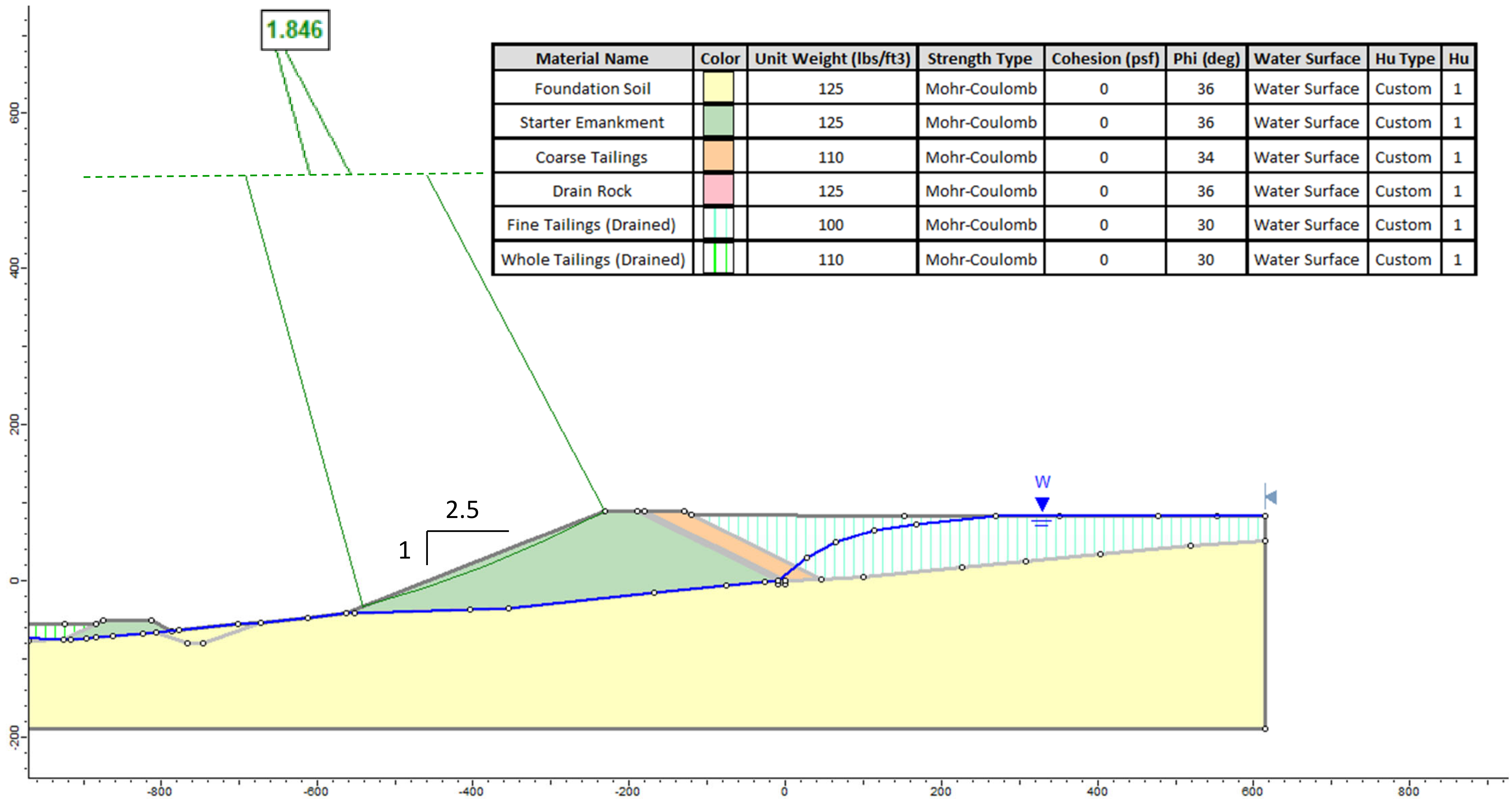
Section TSF-2A1 Final Configuration

- **Static Undrained Conditions**
- **Min. FOS = 1.78**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A1 Final – Static Conditions

wood. Wood Environment & Infrastructure Solutions, Inc.	Figure 4-22		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1
Whole Tailings (Drained)		110	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2A2 Starter Dam
- **Static Drained Conditions**
- **Min. FOS = 1.85**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2A2 Starter Dam – Static Conditions

wood.

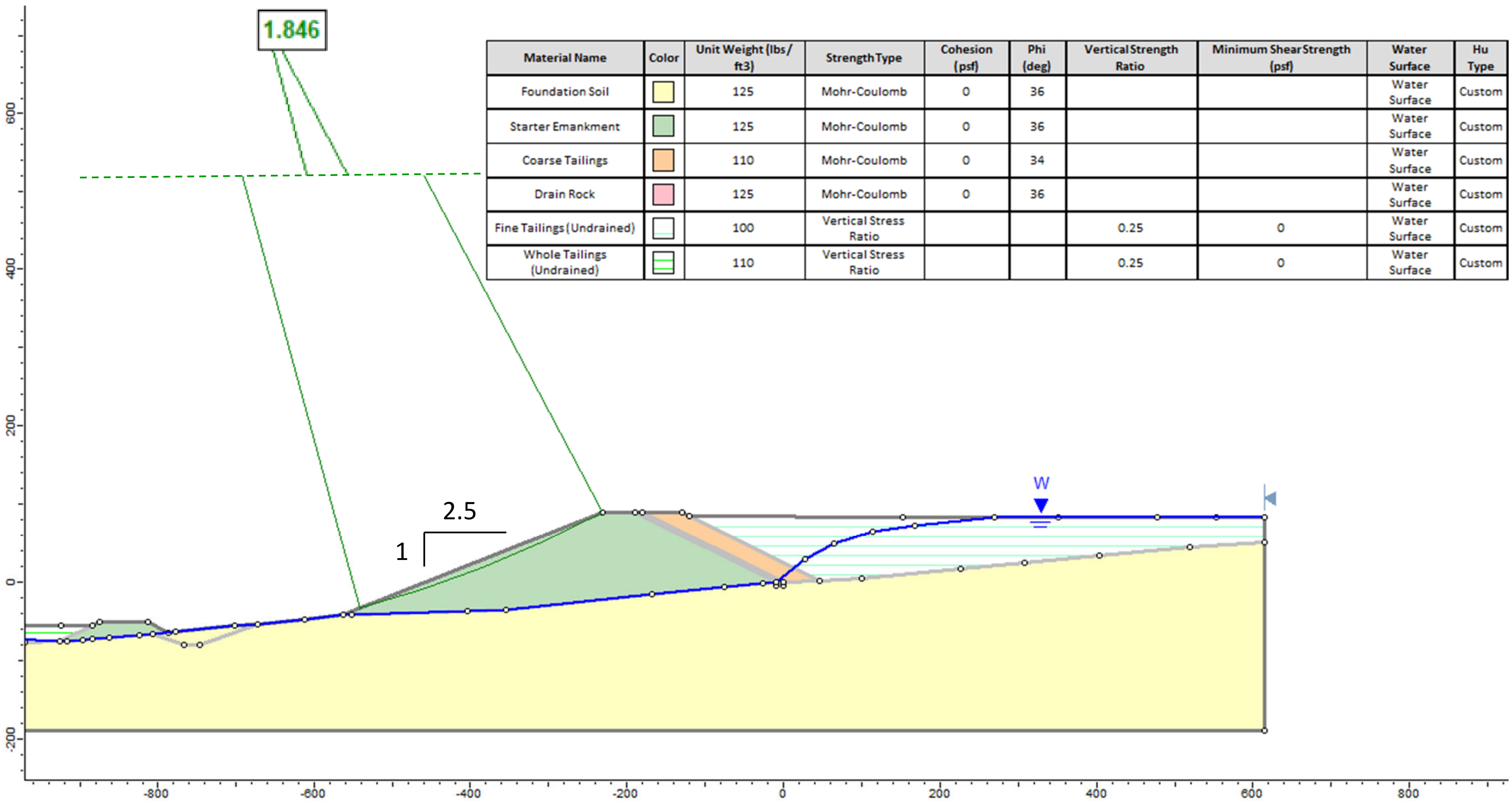
Wood Environment & Infrastructure Solutions, Inc.

Figure 4-23

PROJECT NUMBER: 17-2021-4024

SCALE: N/A DATE: DEC 2021

RCC-CW003852



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom
Whole Tailings (Undrained)		110	Vertical Stress Ratio			0.25	0	Water Surface	Custom

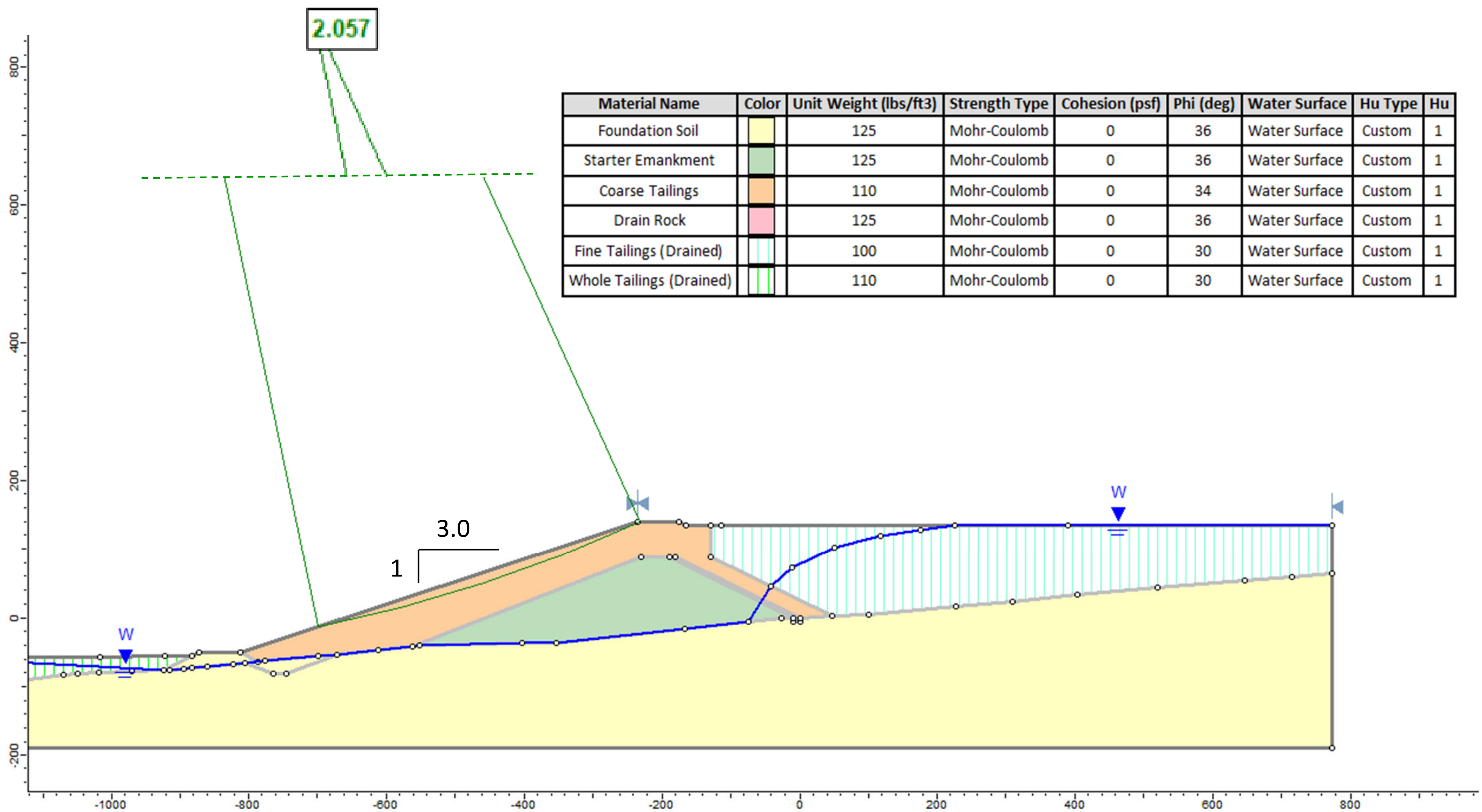
Section TSF-2A2 Starter Dam

- **Static Undrained Conditions**
- **Min. FOS = 1.85**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A2 Starter Dam – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-24
PROJECT NUMBER:	17-2021-4024
SCALE: N/A	DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1
Whole Tailings (Drained)		110	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2A2 Centerline Raise

- **Static Drained Conditions**
- **Min. FOS = 2.06**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2A2 Centerline Raise – Static Conditions

wood.

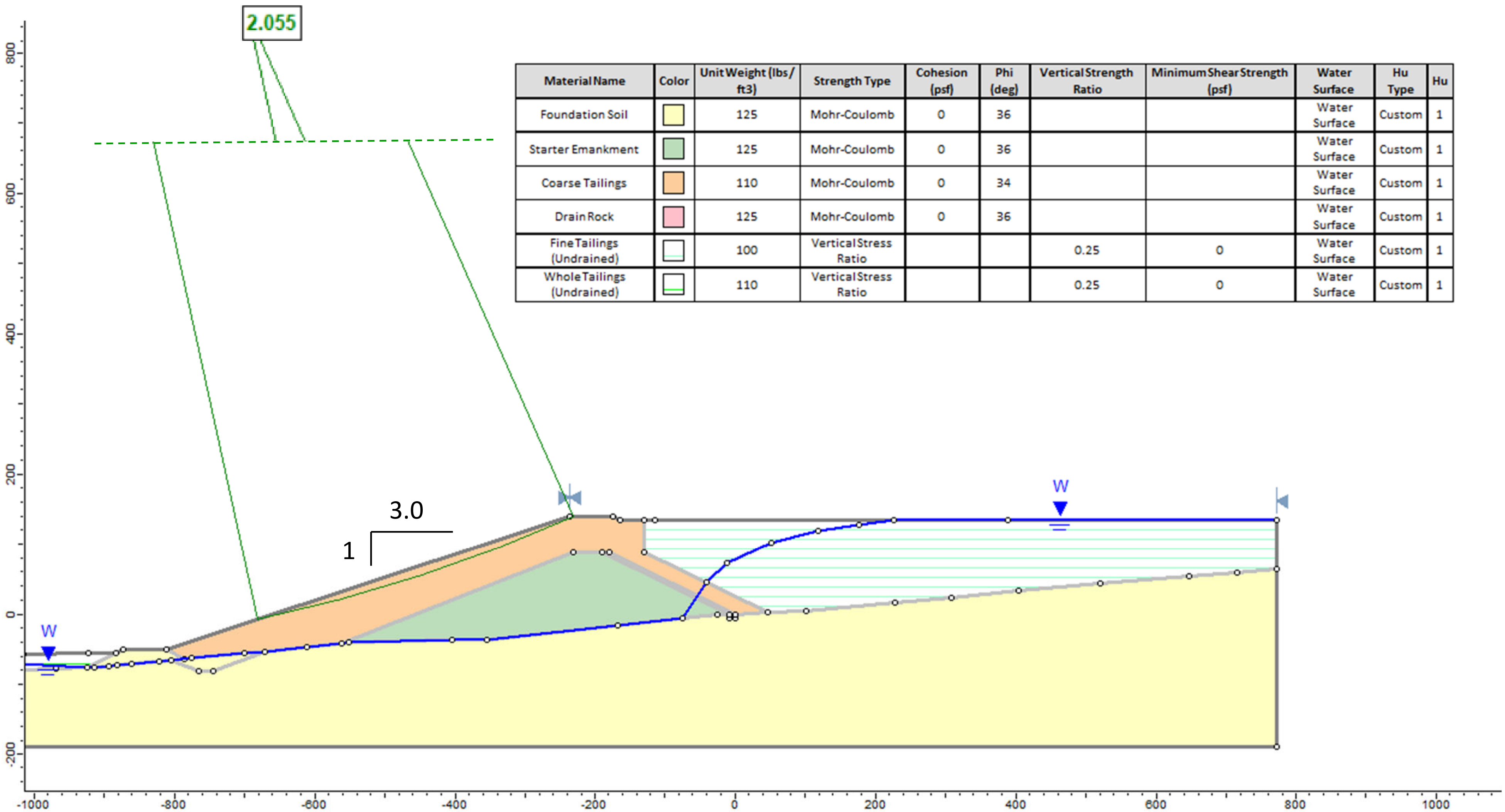
Wood Environment & Infrastructure Solutions, Inc.

Figure 4-25

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1
Whole Tailings (Undrained)		110	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-2A2 Centerline Raise

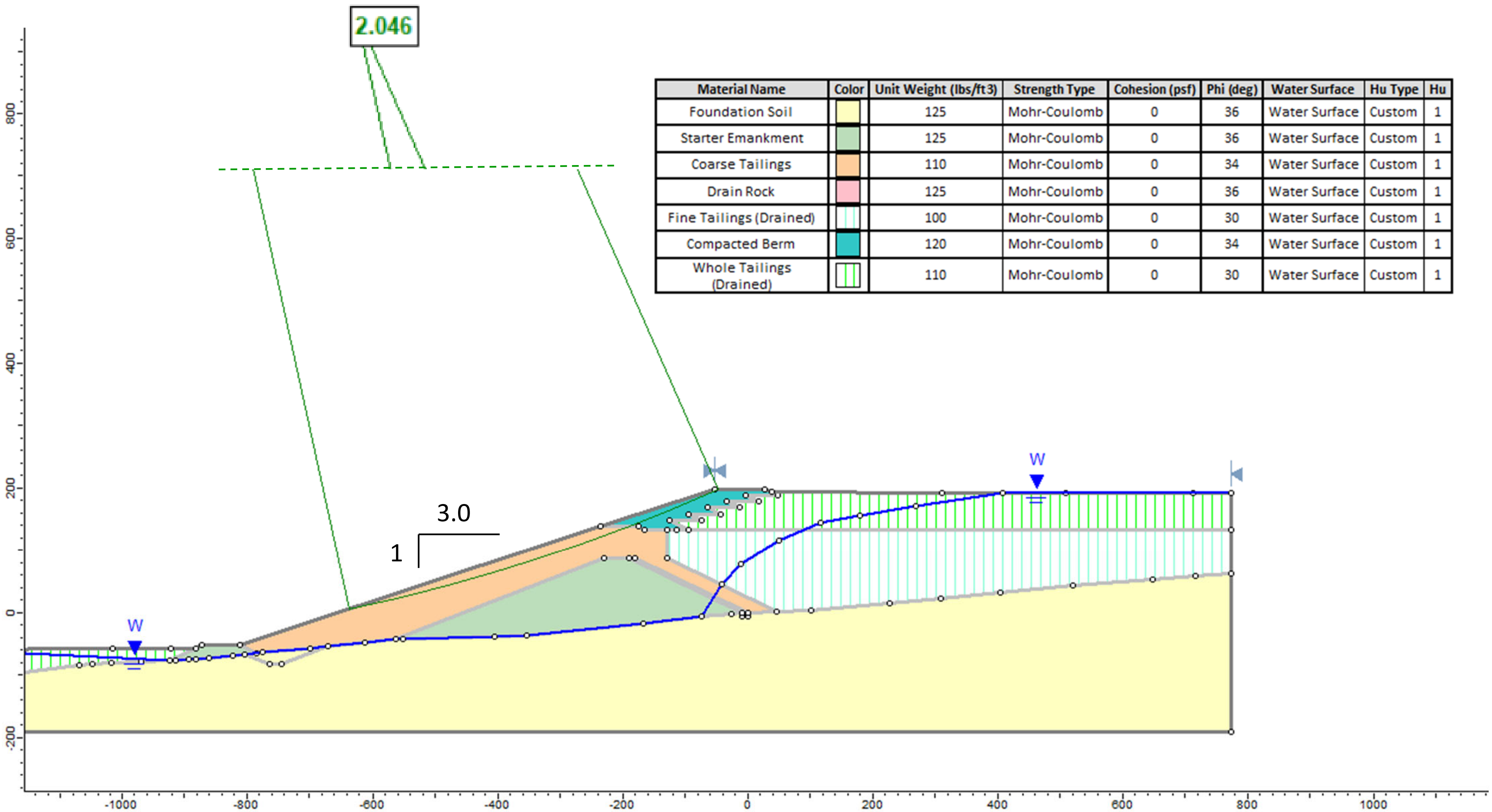
- **Static Undrained Conditions**
- **Min. FOS = 2.06**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A2 Centerline Raise – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-26		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021

RCC-CW003855



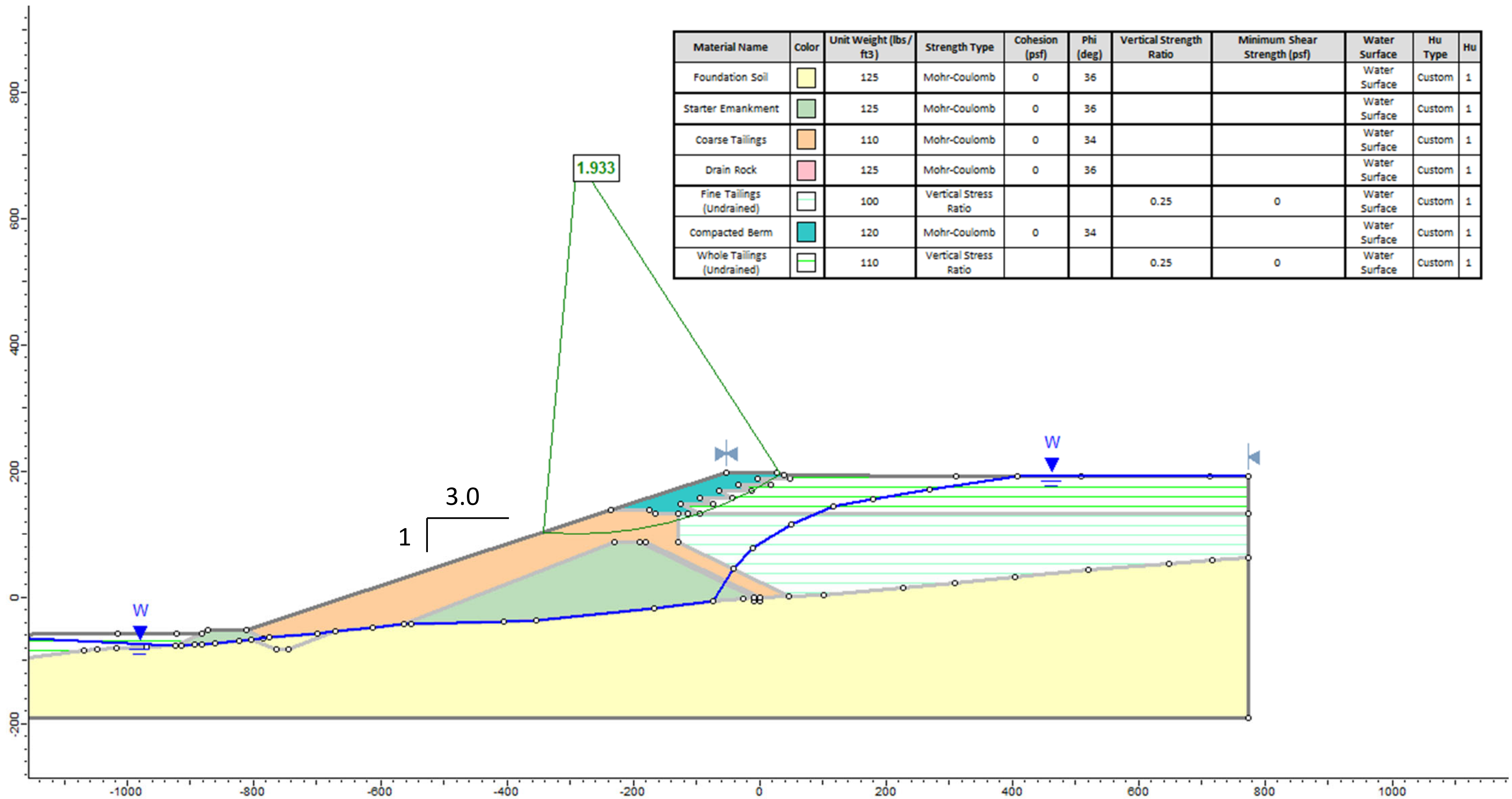
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34	Water Surface	Custom	1
Whole Tailings (Drained)		110	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2A2 Final Configuration

- **Static Drained Conditions**
- **Min. FOS = 2.05**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2A2 Final – Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-27 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

RCC-CW003856



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained)		110	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-2A2 Final Configuration

- **Static Undrained Conditions**
- **Min. FOS = 1.93**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

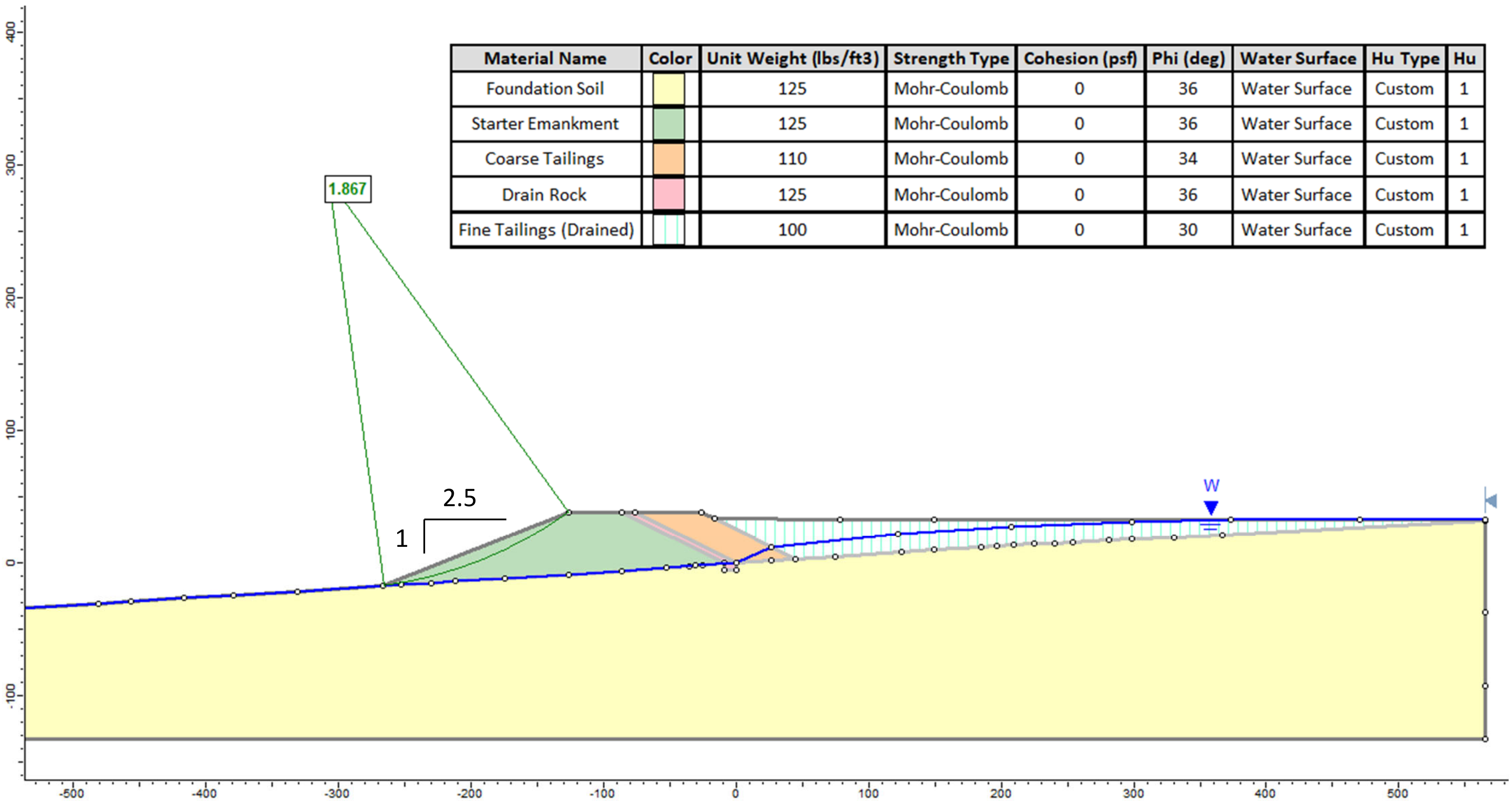
Section TSF-2A2 Final – Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

Figure 4-28

PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2B Starter Dam

- **Static Drained Conditions**
- **Min. FOS = 1.87**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

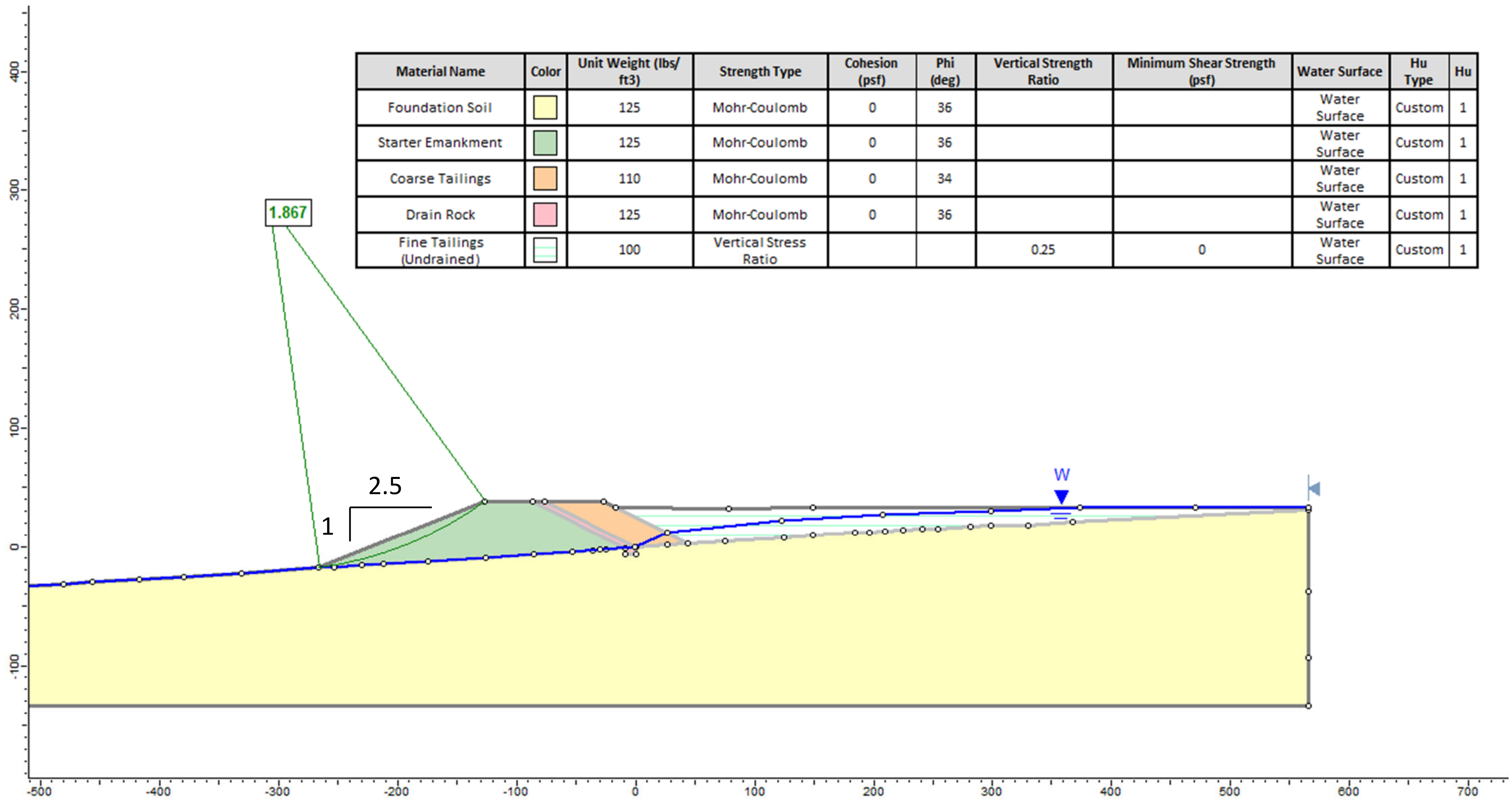
Section TSF-2B Starter Dam – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-29

PROJECT NUMBER: 17-2021-4024

SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-2B Starter Dam
- **Static Undrained Conditions**
- **Min. FOS = 1.87**

Rosemont Copper Company

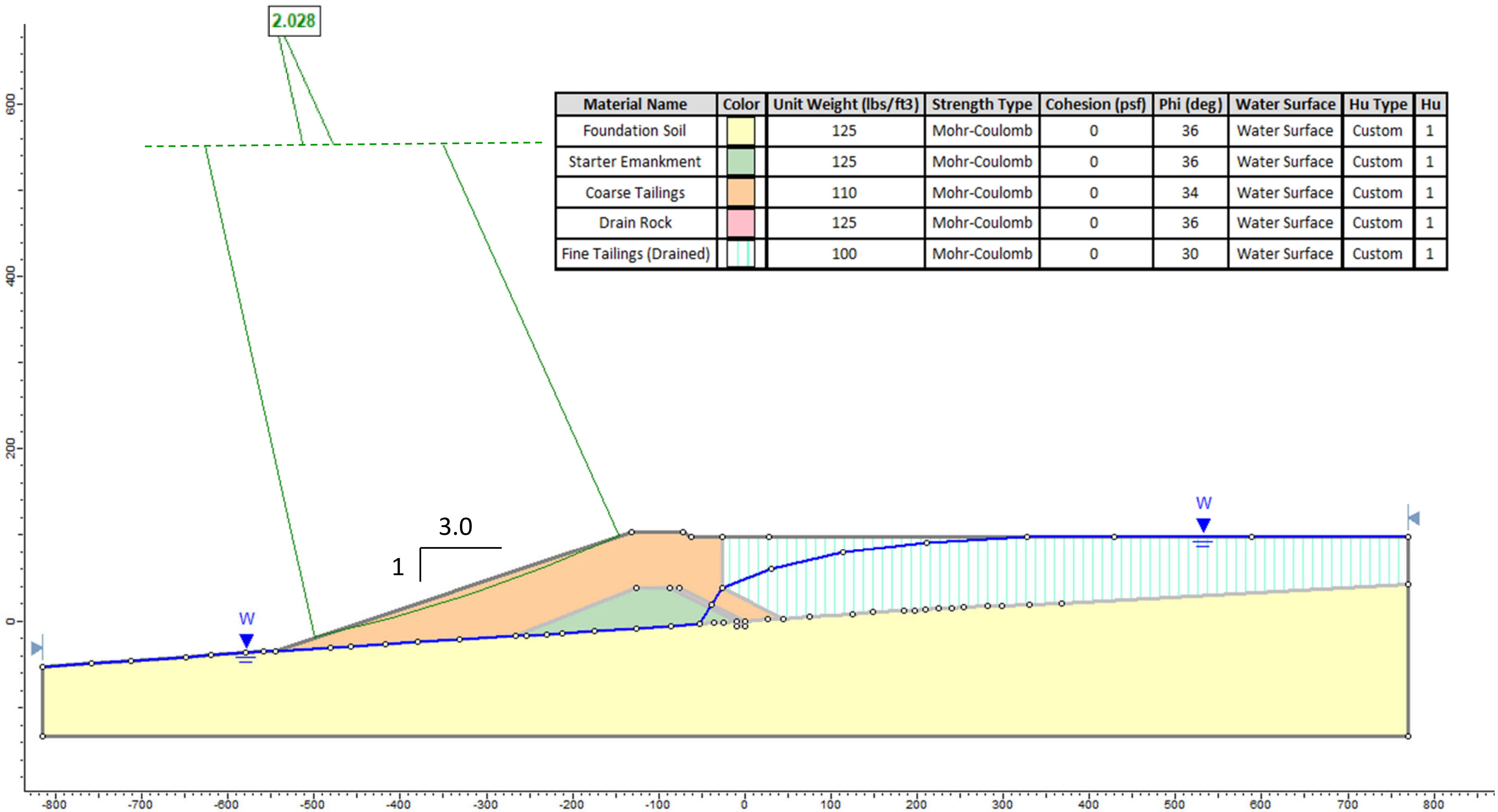
Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2B Starter Dam – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-30

PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2B Centerline Raise

- **Static Drained Conditions**
- **Min. FOS = 2.03**

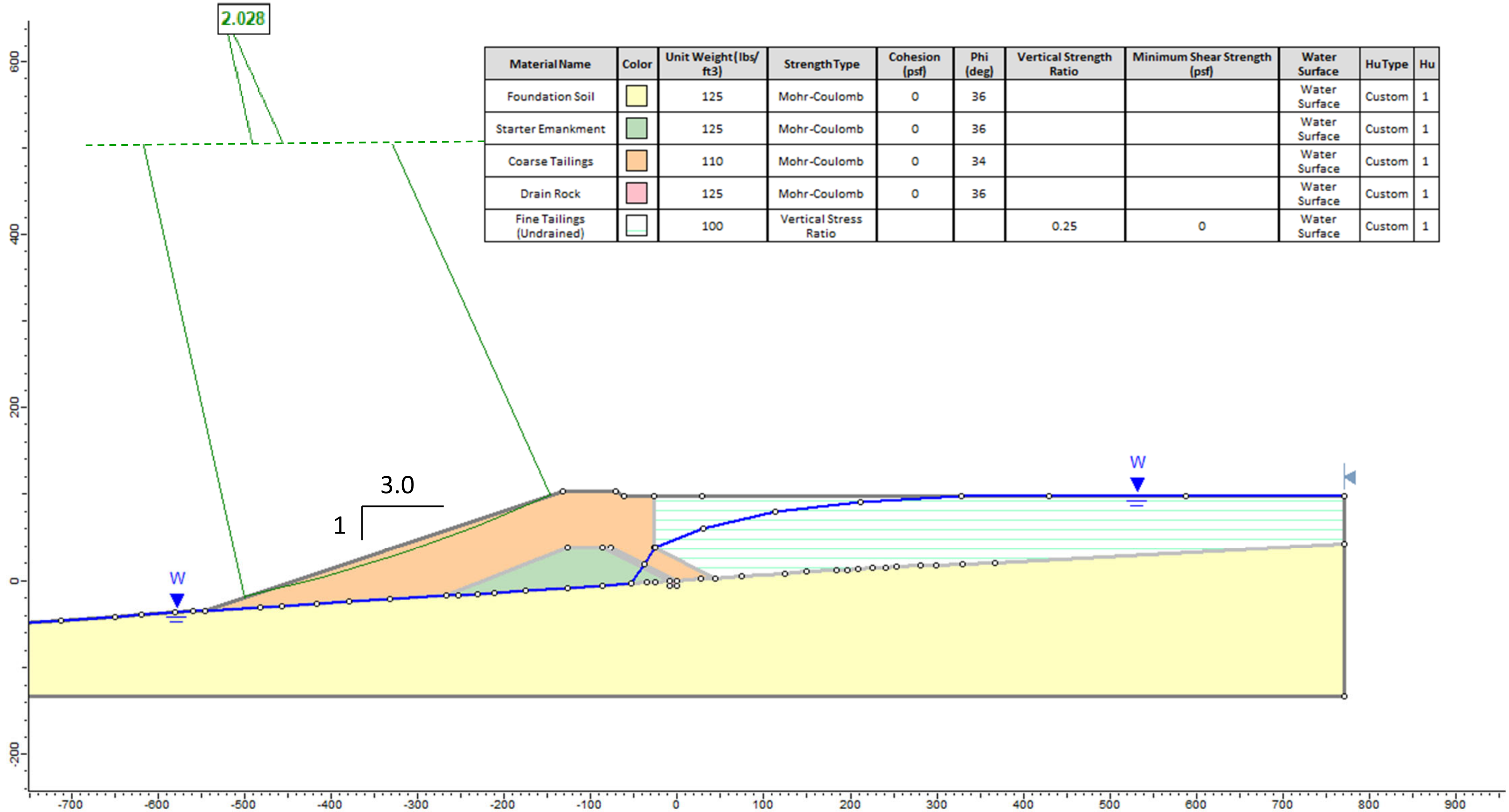
Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2B Centerline Raise – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-31

PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021

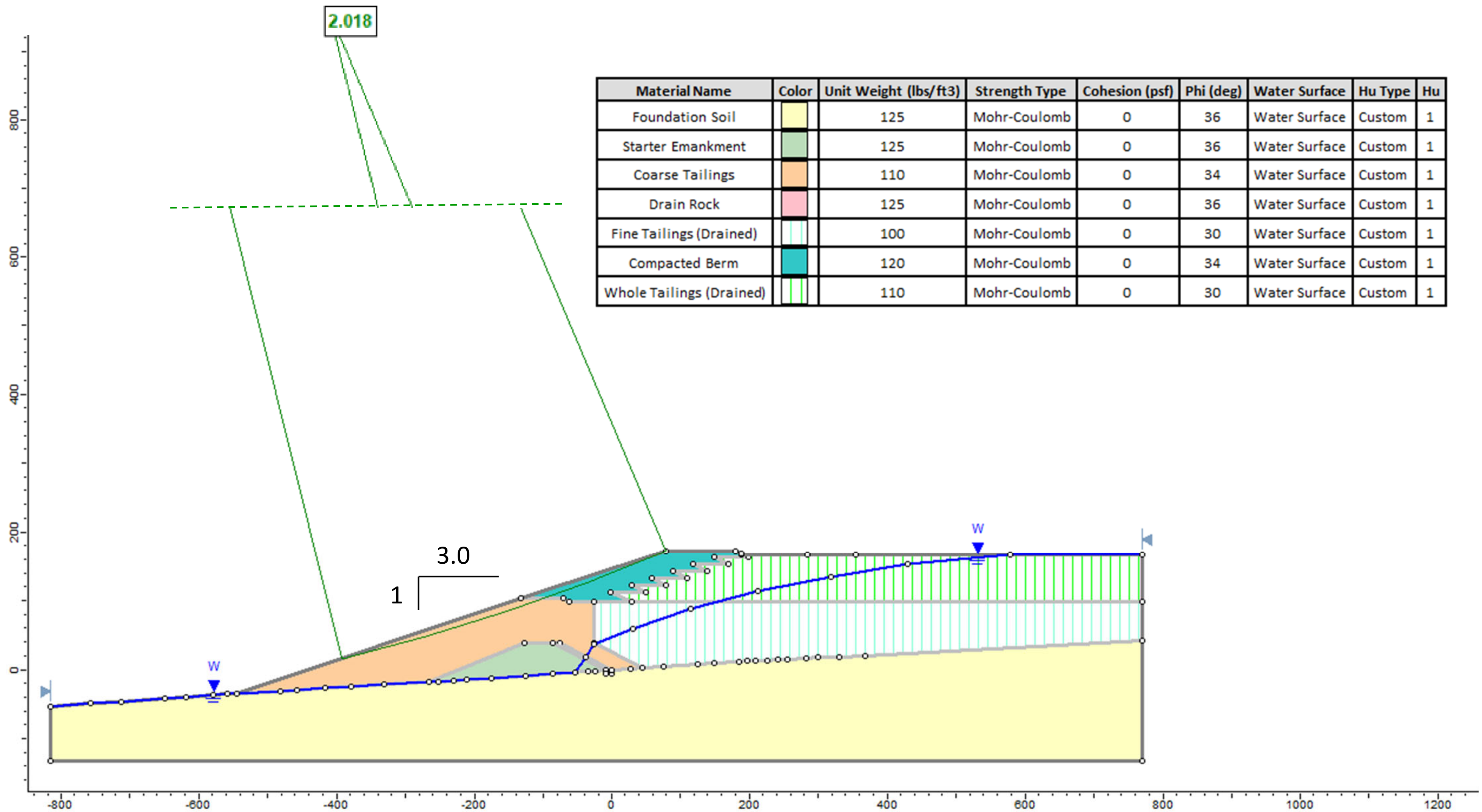


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

Section TSF-2B Centerline Raise

- **Static Undrained Conditions**
- **Min. FOS = 2.03**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2B Centerline Raise – Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-32 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34	Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36	Water Surface	Custom	1
Fine Tailings (Drained)		100	Mohr-Coulomb	0	30	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34	Water Surface	Custom	1
Whole Tailings (Drained)		110	Mohr-Coulomb	0	30	Water Surface	Custom	1

Section TSF-2B Final Configuration

- **Static Drained Conditions**
- **Min. FOS = 2.02**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2B Final – Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

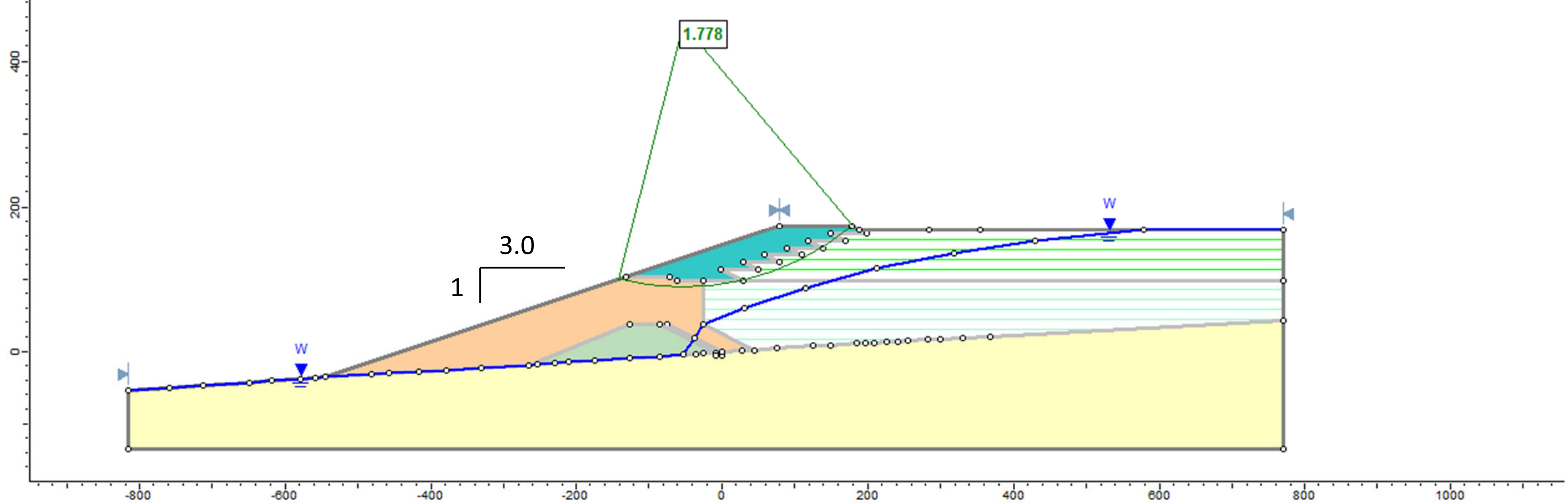
Figure 4-33

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained)		110	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1



Section TSF-2B Final Configuration

- **Static Undrained Conditions**
- **Min. FOS = 1.78**

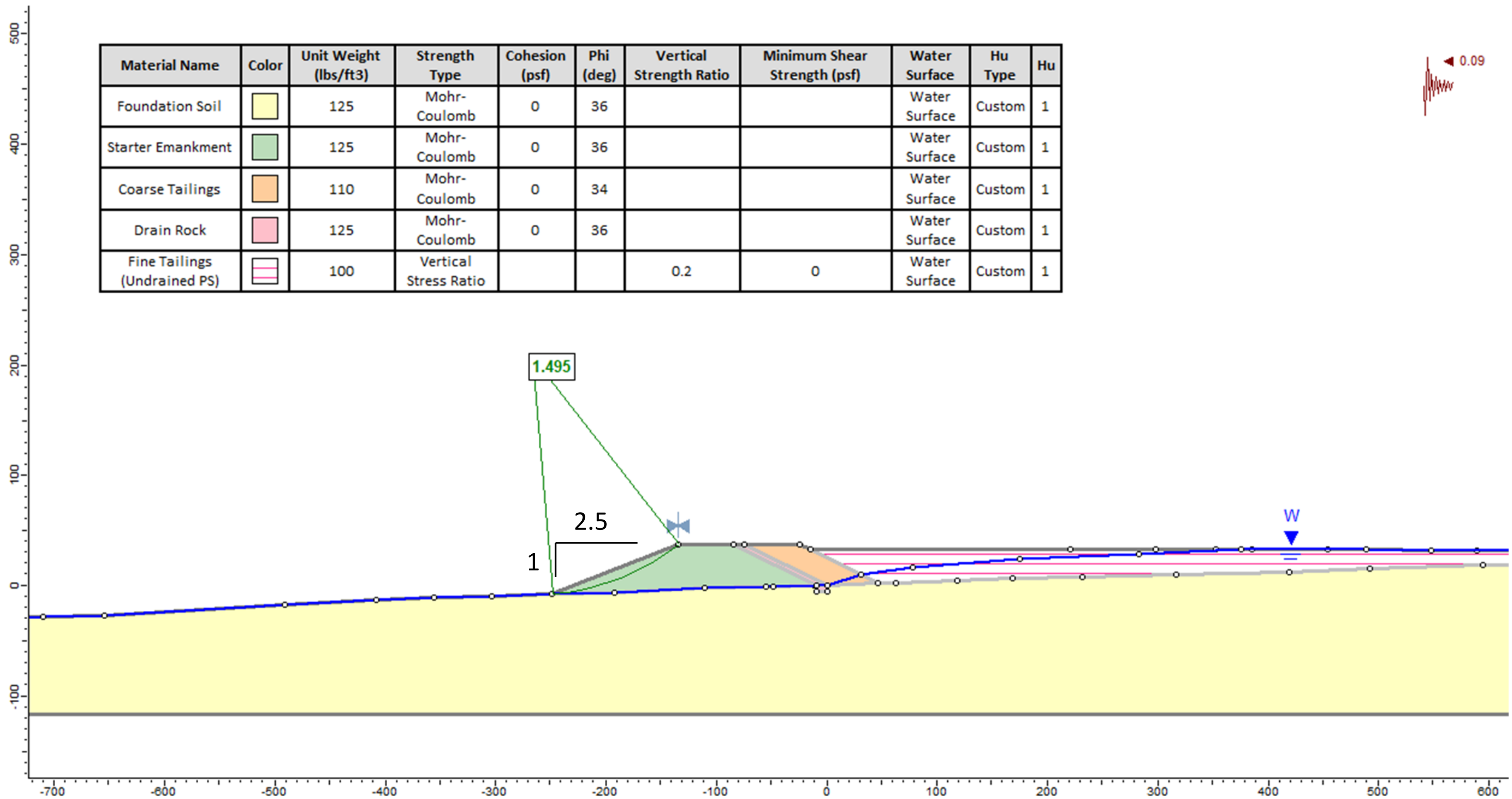
Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2B Final – Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-34			
	PROJECT NUMBER:	17-2021-4024		
	SCALE:	N/A	DATE:	DEC 2021

RCC-CW003863

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

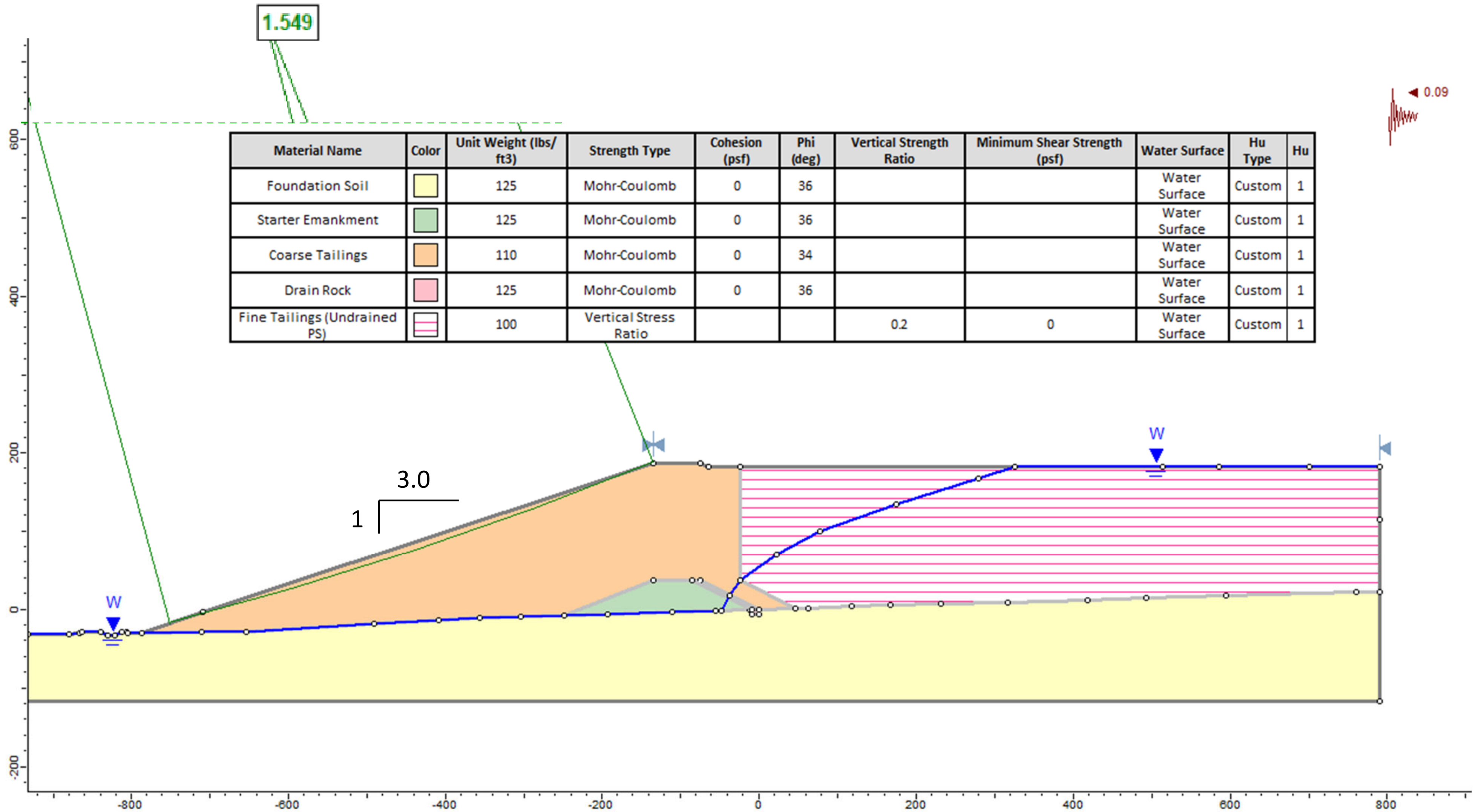


Section TSF-1A Starter Dam

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.50**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-1A Starter Dam – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-35 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

RCC-CW003864

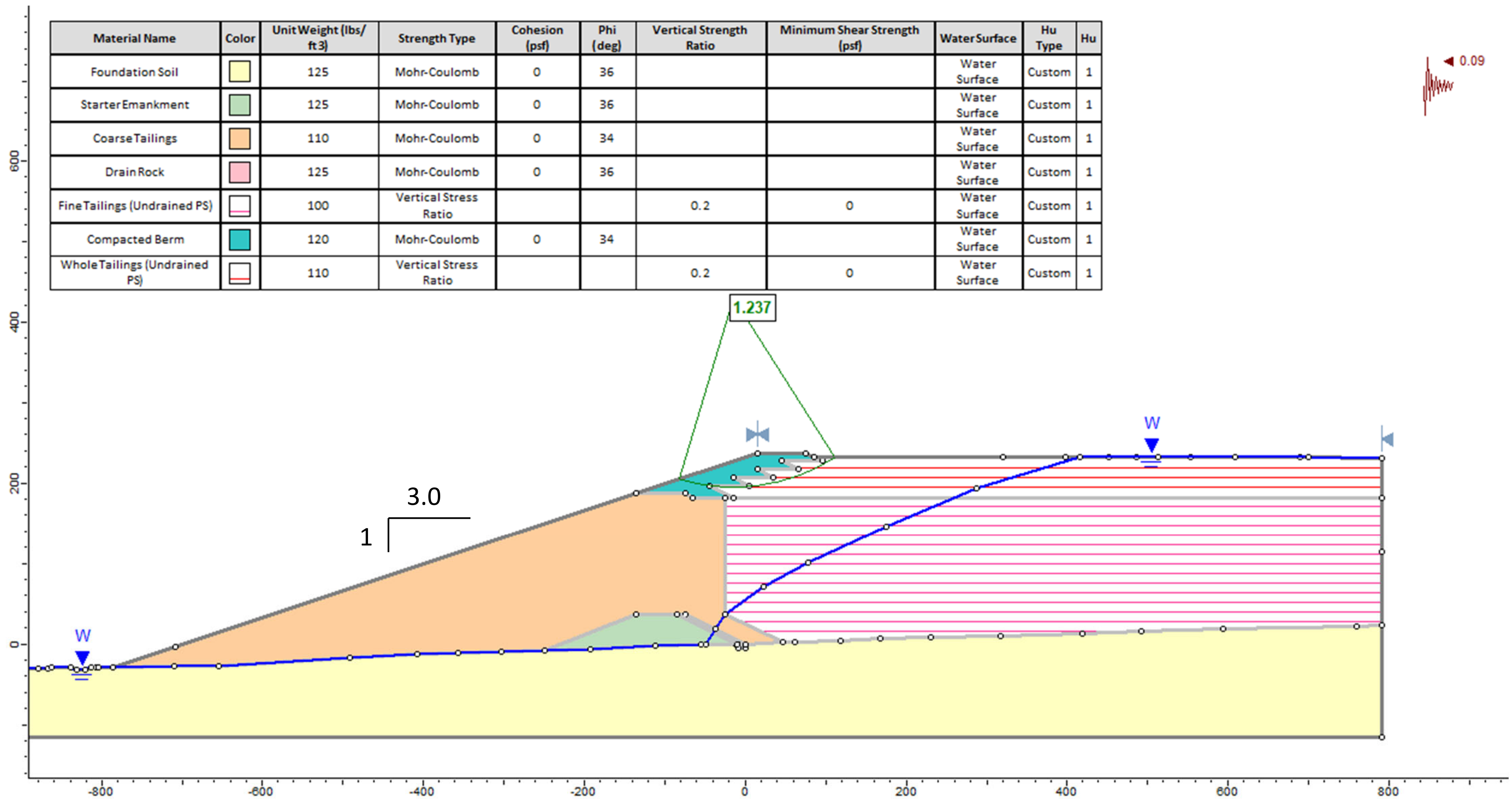


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

Section TSF-1A Centerline Raise

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.55**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-1A Centerline – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-36 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

Section TSF-1A Final Configuration

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.24**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

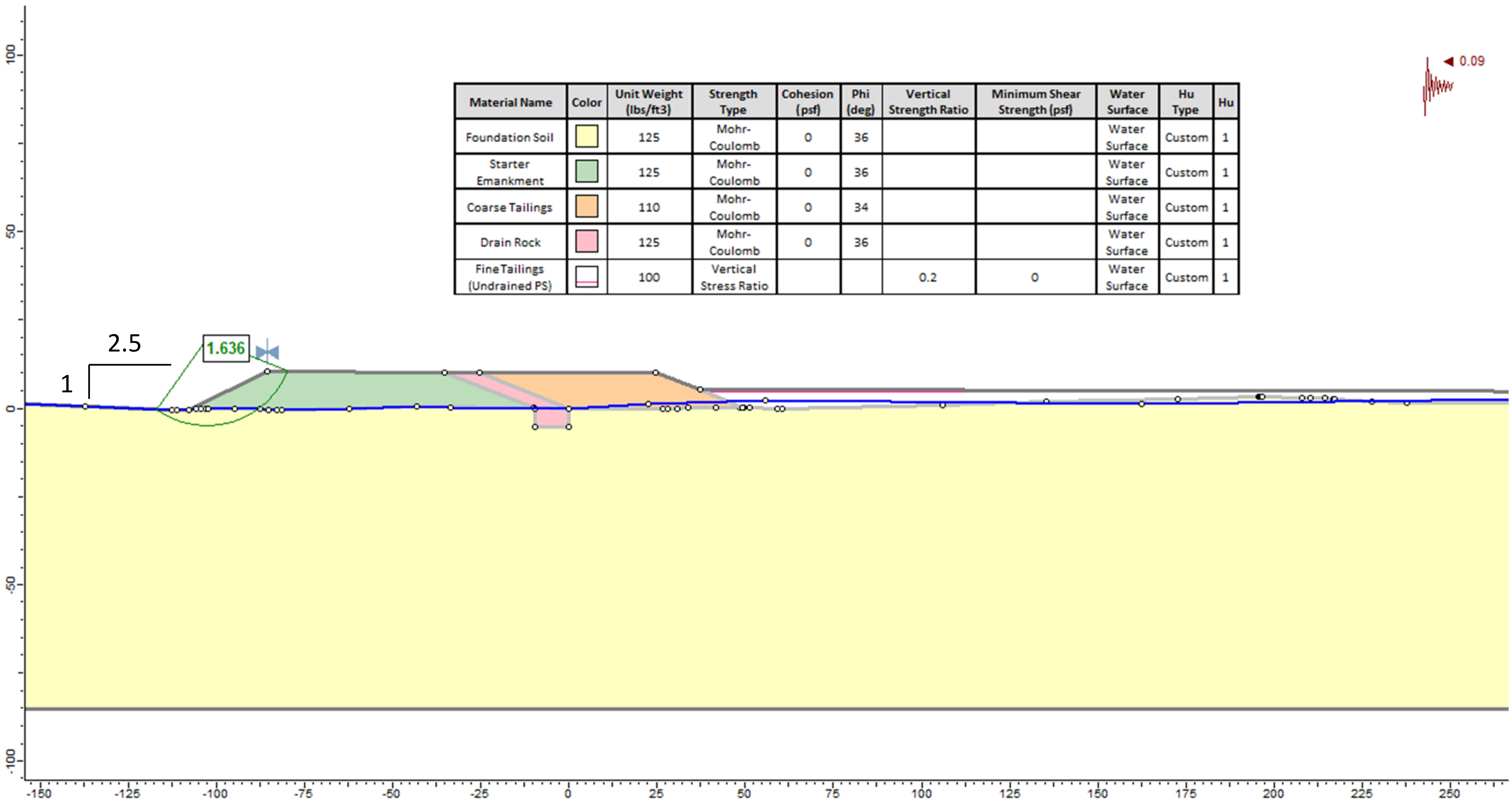
Section TSF-1A Final – Pseudo-Static Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

Figure 4-37

PROJECT NUMBER:	17-2021-4024
SCALE: N/A	DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

Section TSF-1B Starter Dam

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.64**

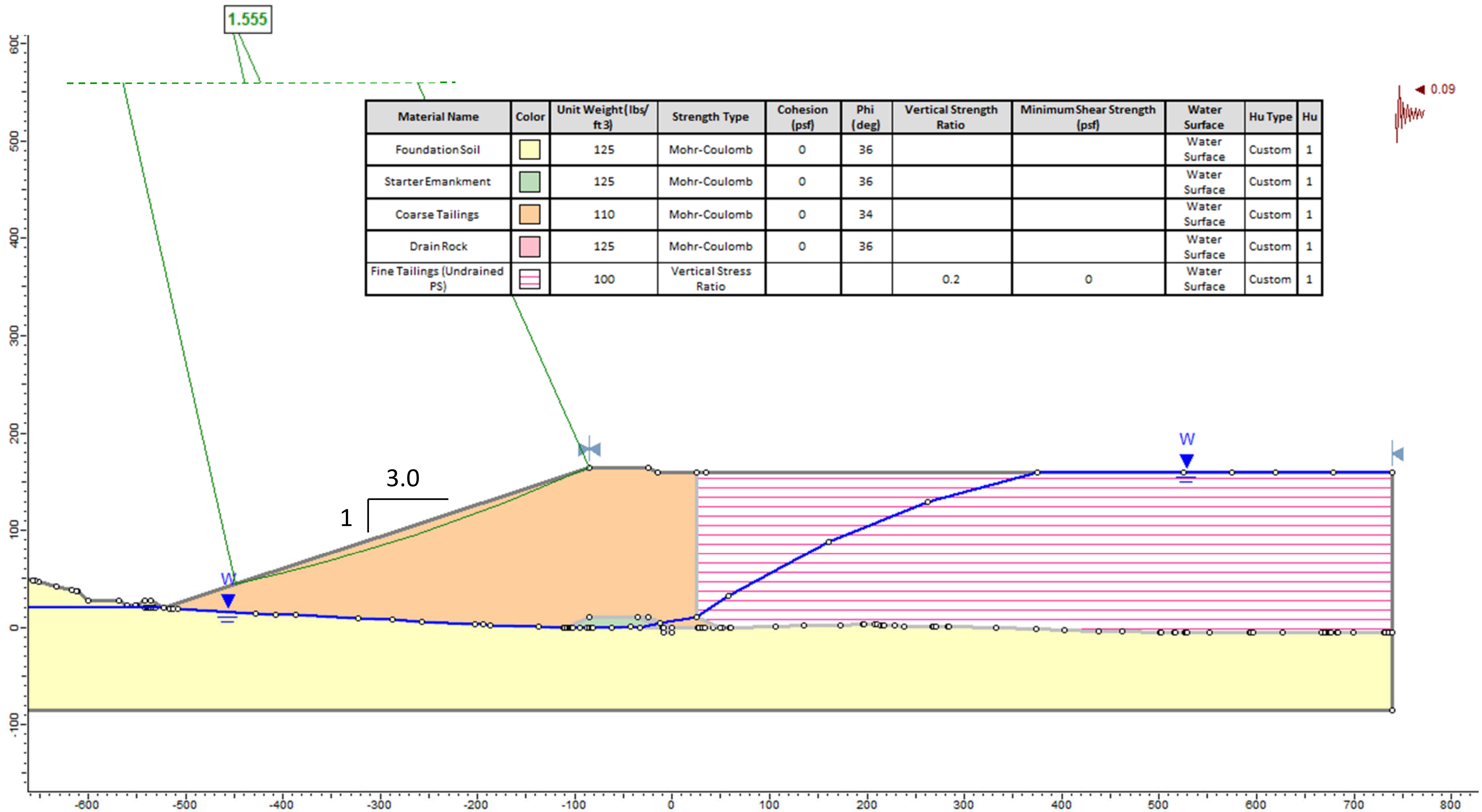
Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-1B Starter Dam – Pseudo-Static Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-38

PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

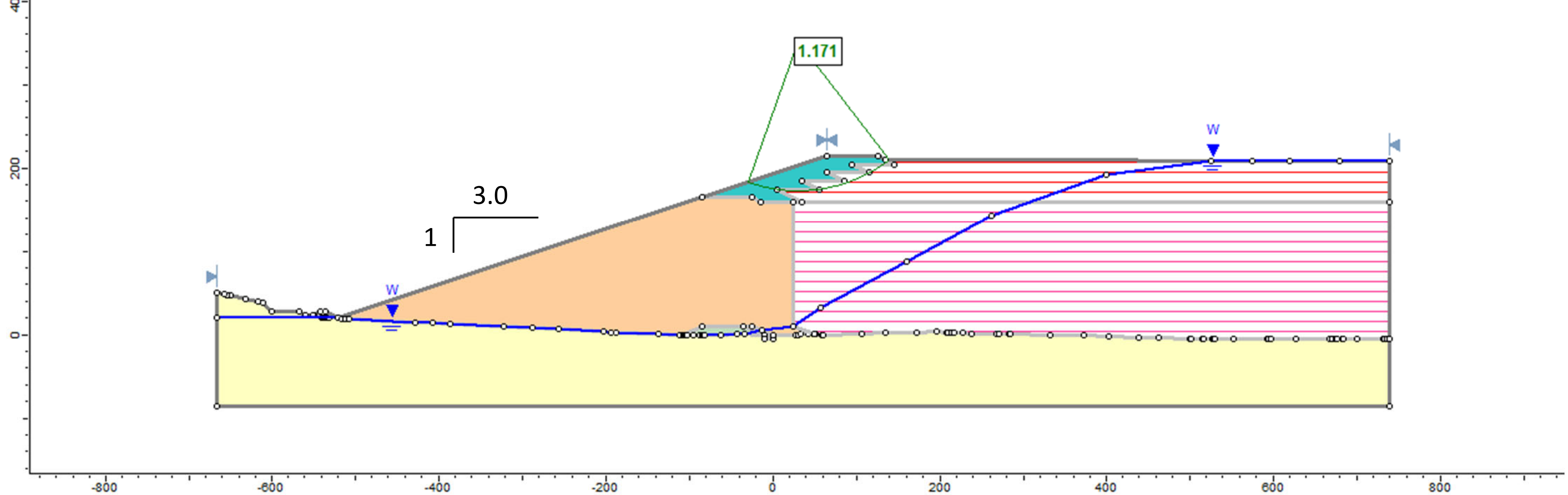
Section TSF-1B Centerline Raise

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.56**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-1B Centerline – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-39 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

RCC-CW003868

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1



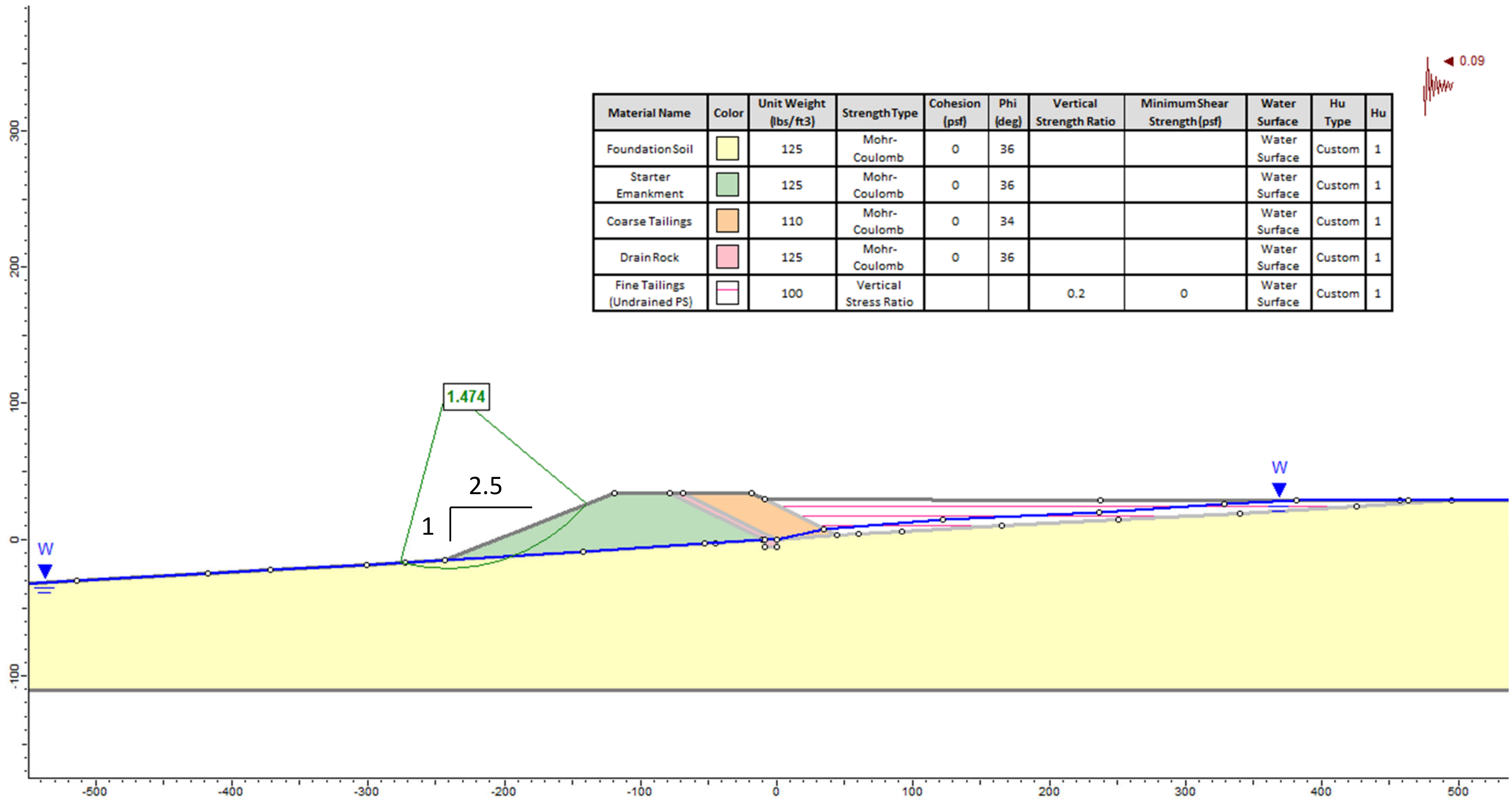
Section TSF-1B Final Configuration

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.17**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-1B Final – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-40 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

RCC-CW003869

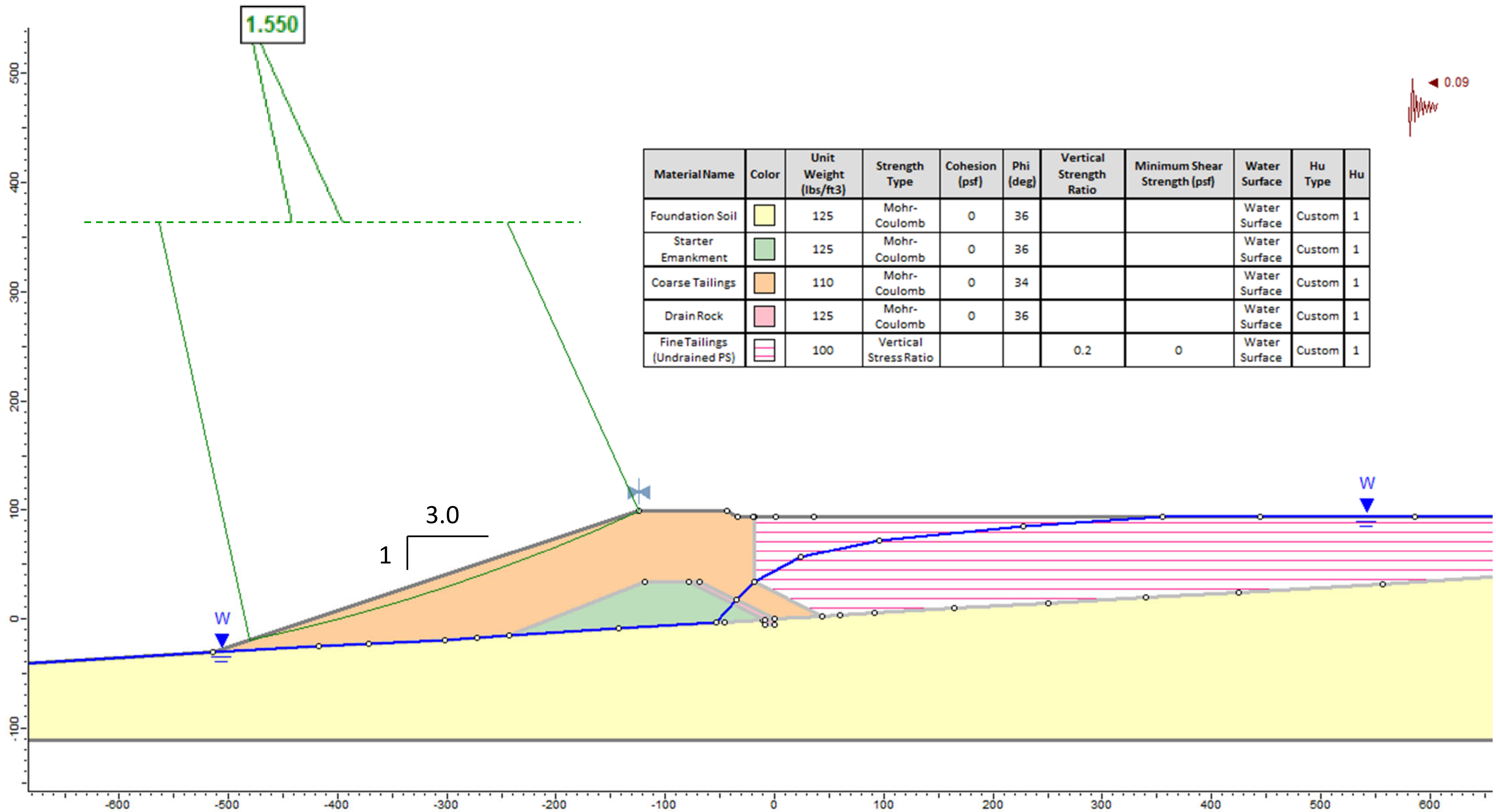
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1



Section TSF-2A1 Starter Dam

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.47**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2A1 Starter Dam – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-41 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

Section TSF-2A1 Centerline Raise

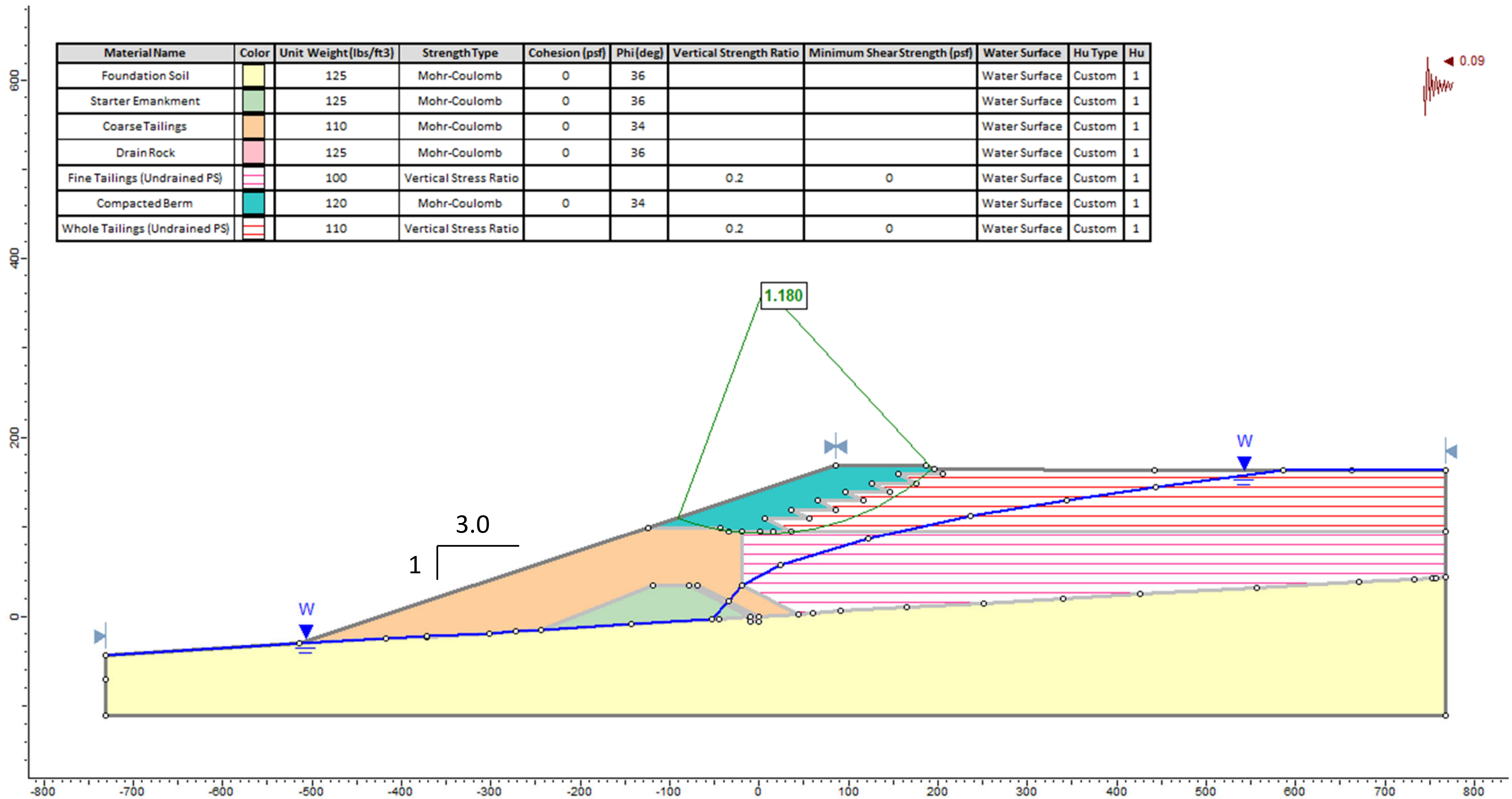
- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.55**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A1 Centerline – Pseudo-Static Conditions

wood. Wood Environment & Infrastructure Solutions, Inc.	Figure 4-42		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

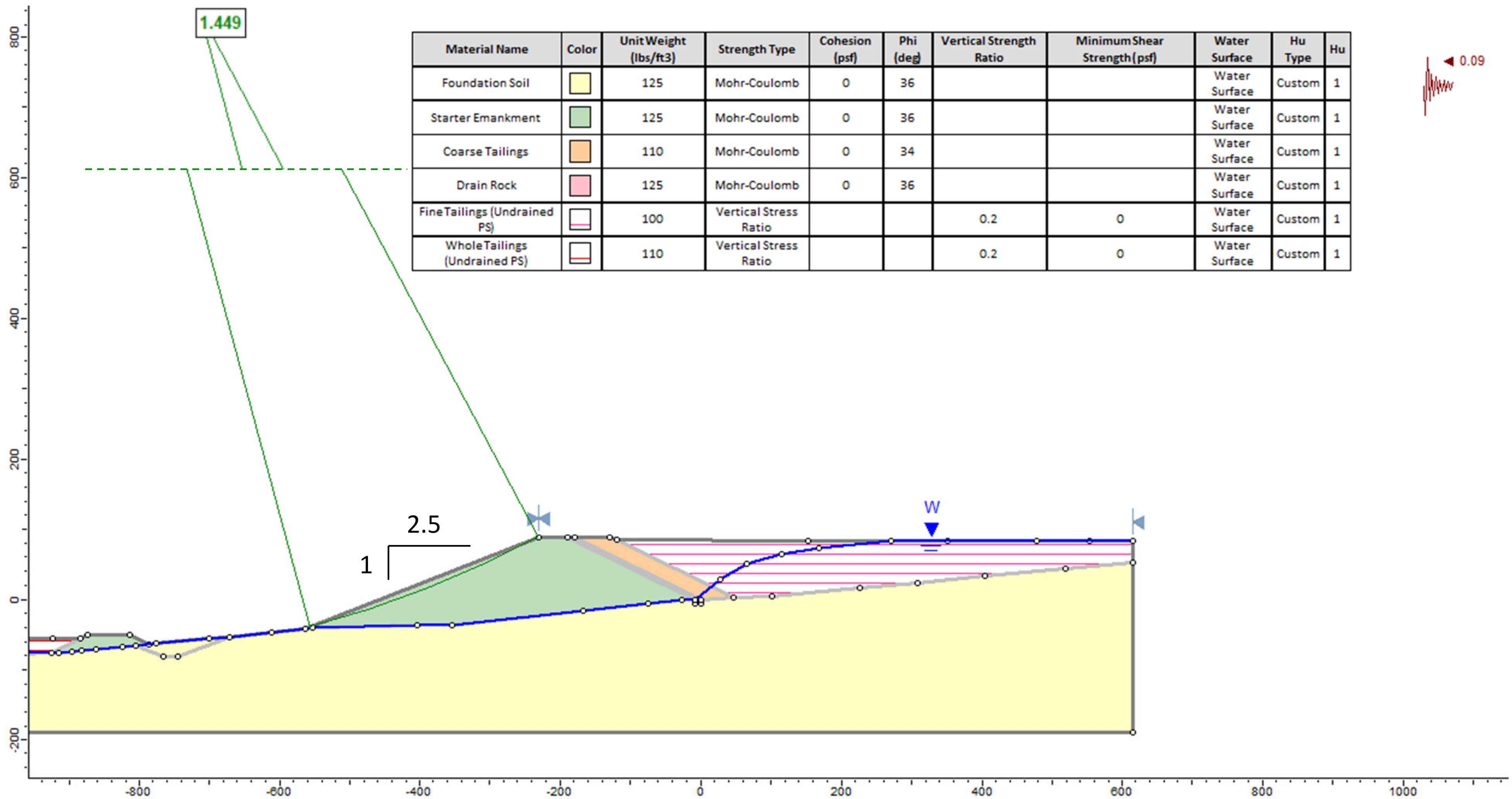


Section TSF-2A1 Final Configuration

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.18**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2A1 Final – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-43 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

RCC-CW003872



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

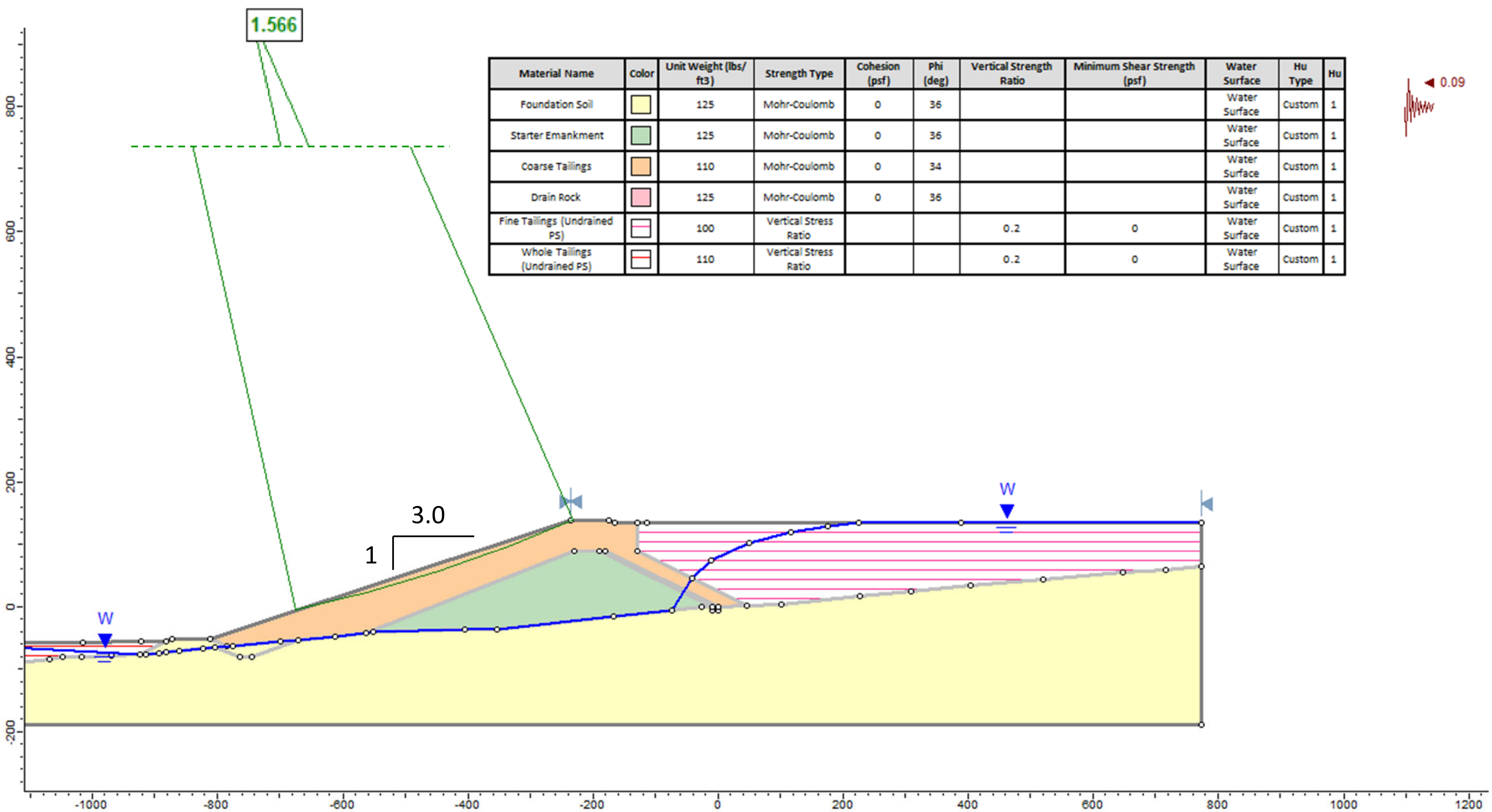
Section TSF-2A2 Starter Dam

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.45**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A2 Starter Dam – Pseudo-Static Conditions

wood. Wood Environment & Infrastructure Solutions, Inc.	Figure 4-44		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021



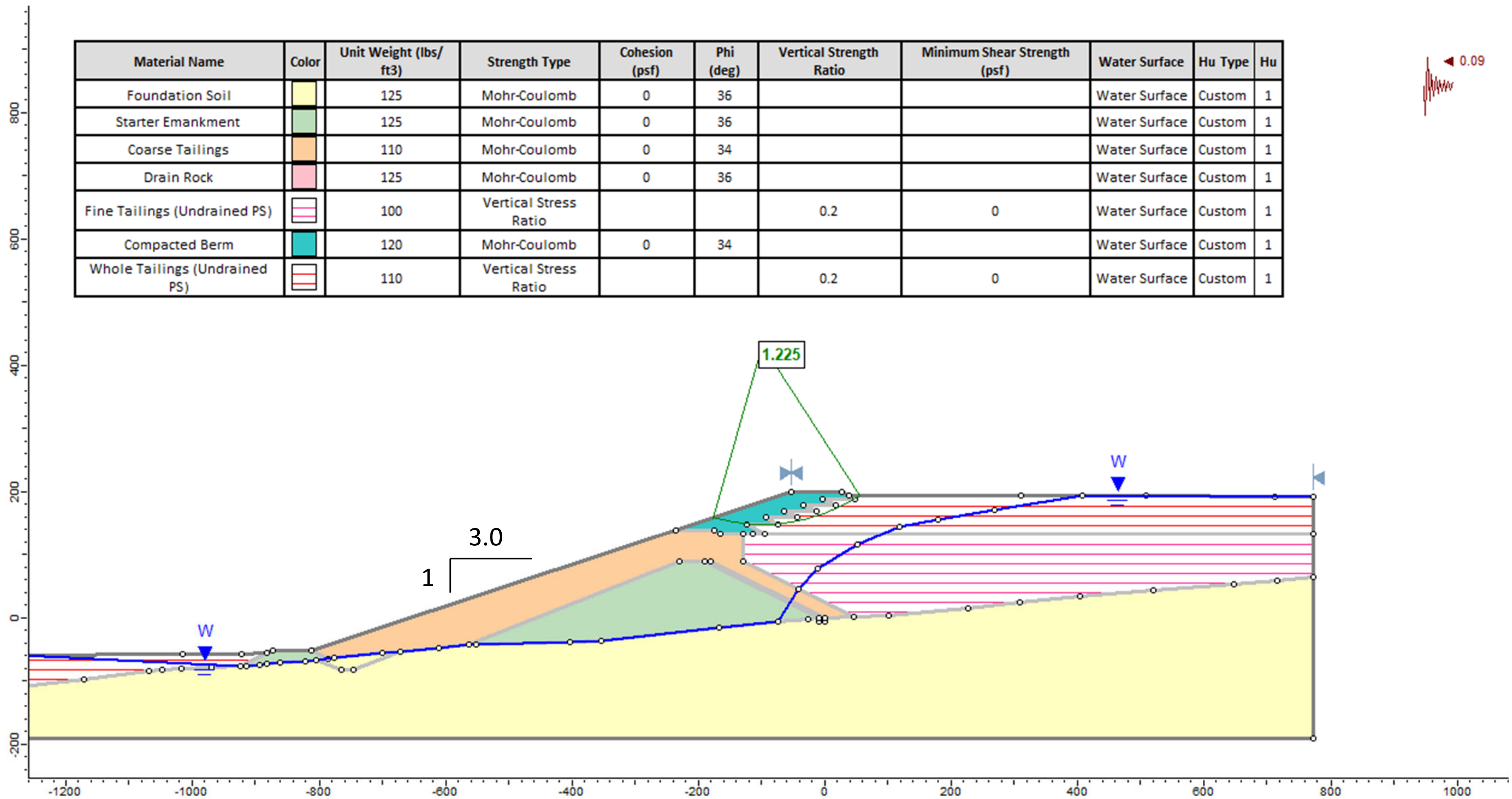
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

Section TSF-2A2 Centerline Raise

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.57**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2A2 Centerline – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-45 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1



Section TSF-2A2 Final Configuration

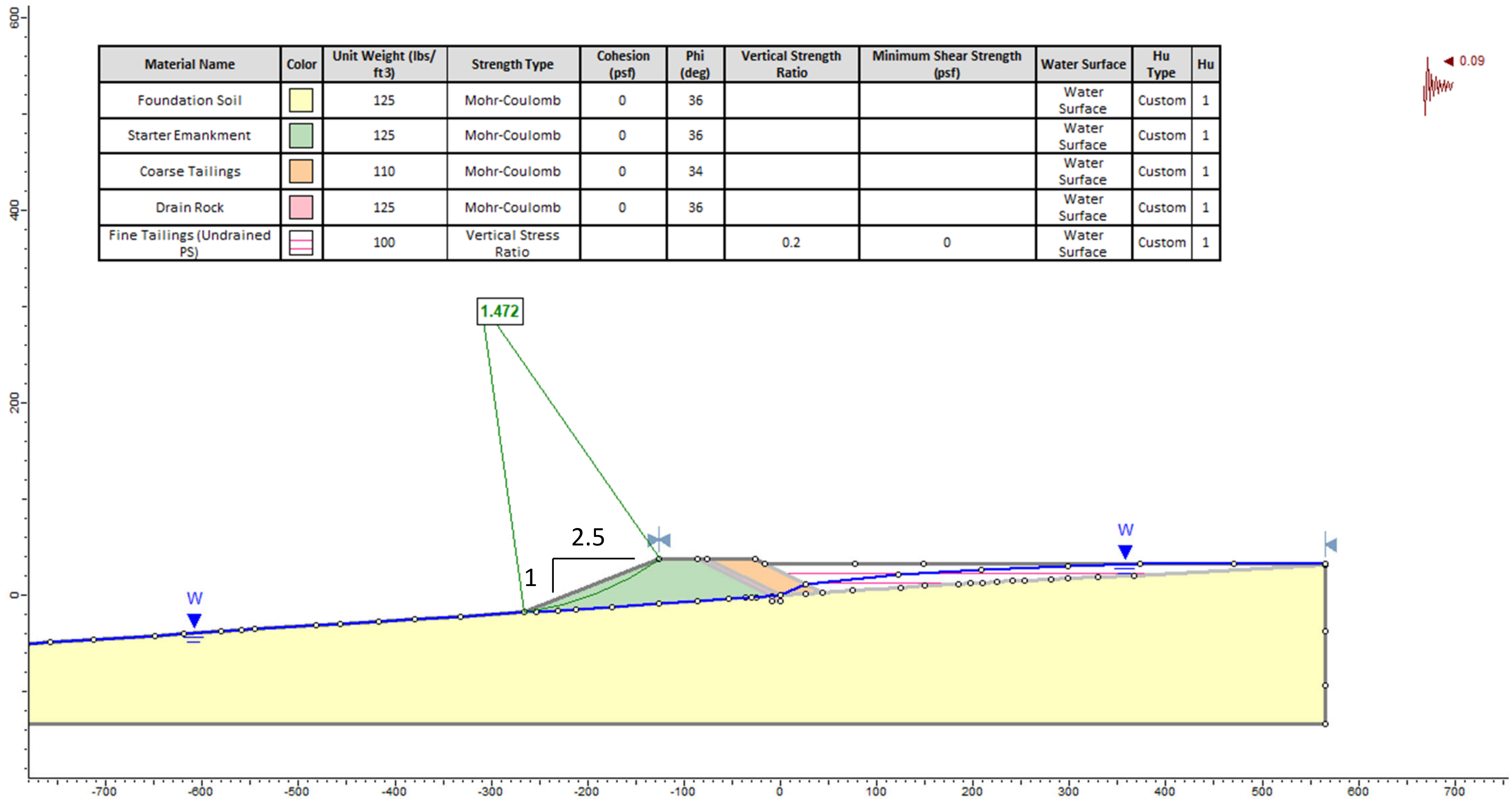
- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.23**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A2 Final – Pseudo-Static Conditions

wood. Wood Environment & Infrastructure Solutions, Inc.	Figure 4-46		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021

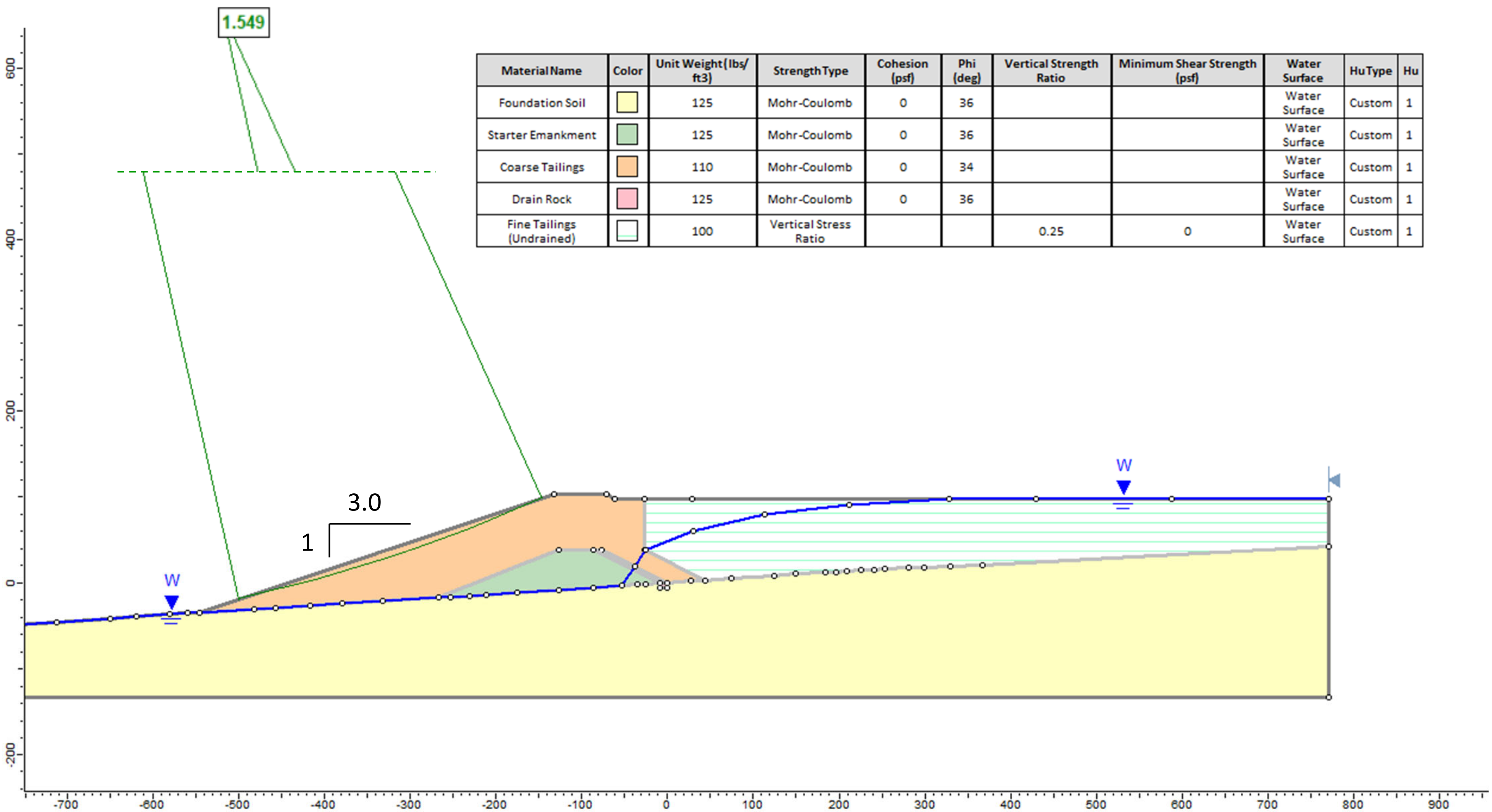
Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1



Section TSF-2B Starter Dam

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.47**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2B Starter Dam – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-47 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained)		100	Vertical Stress Ratio			0.25	0	Water Surface	Custom	1

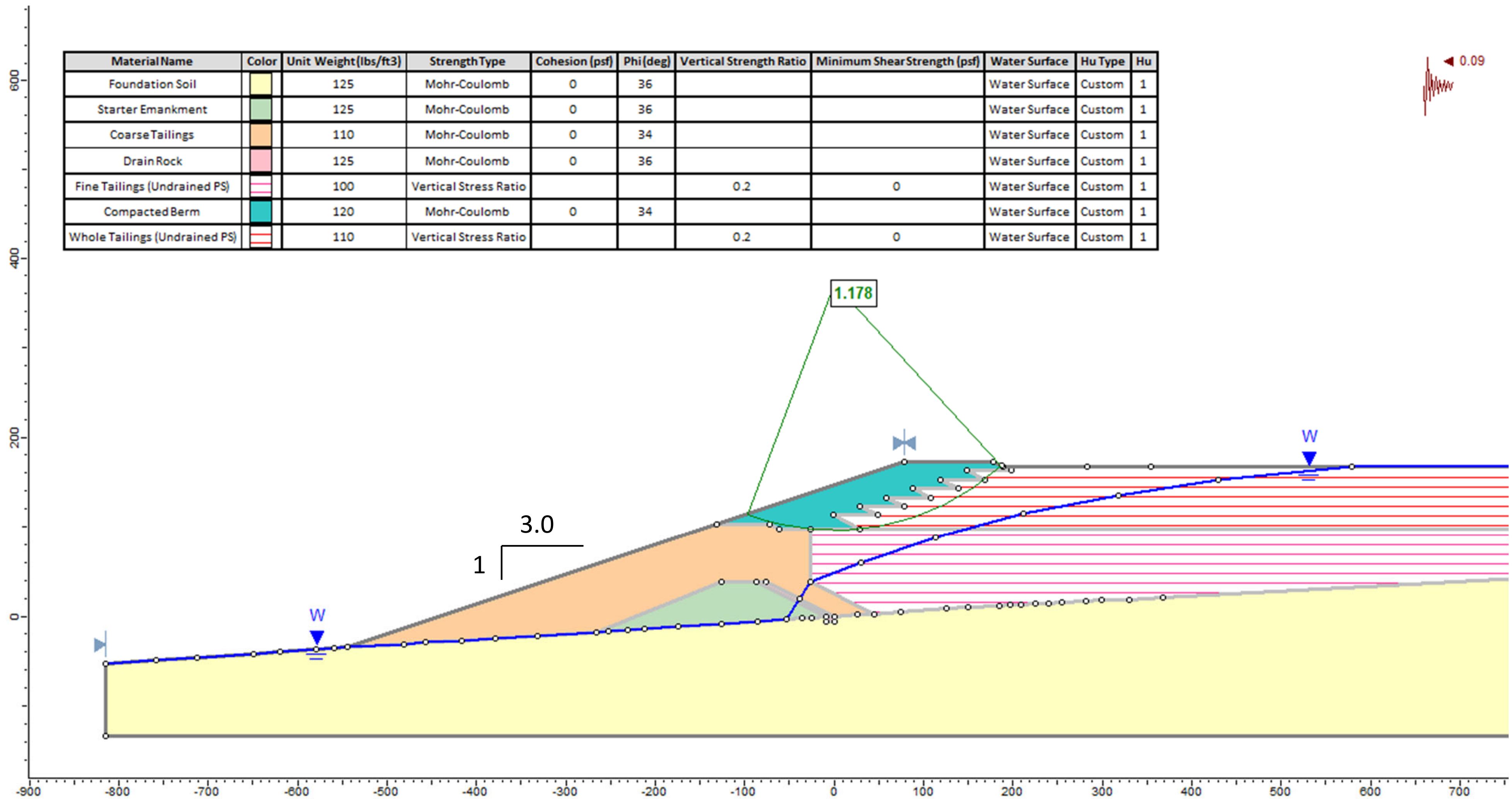
Section TSF-2B Centerline Raise

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.55**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2B Centerline – Pseudo-Static Conditions

wood. Wood Environment & Infrastructure Solutions, Inc.	Figure 4-48		
	PROJECT NUMBER:	17-2021-4024	
	SCALE: N/A	DATE:	DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

Section TSF-2B Final Configuration

- **Pseudo-Static Conditions**
- **Design event with 10,000-year return interval (PGA = 0.17g)**
- **Seismic coefficient = 0.09g**
- **Min. FOS = 1.18**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2B Final – Pseudo-Static Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-49 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

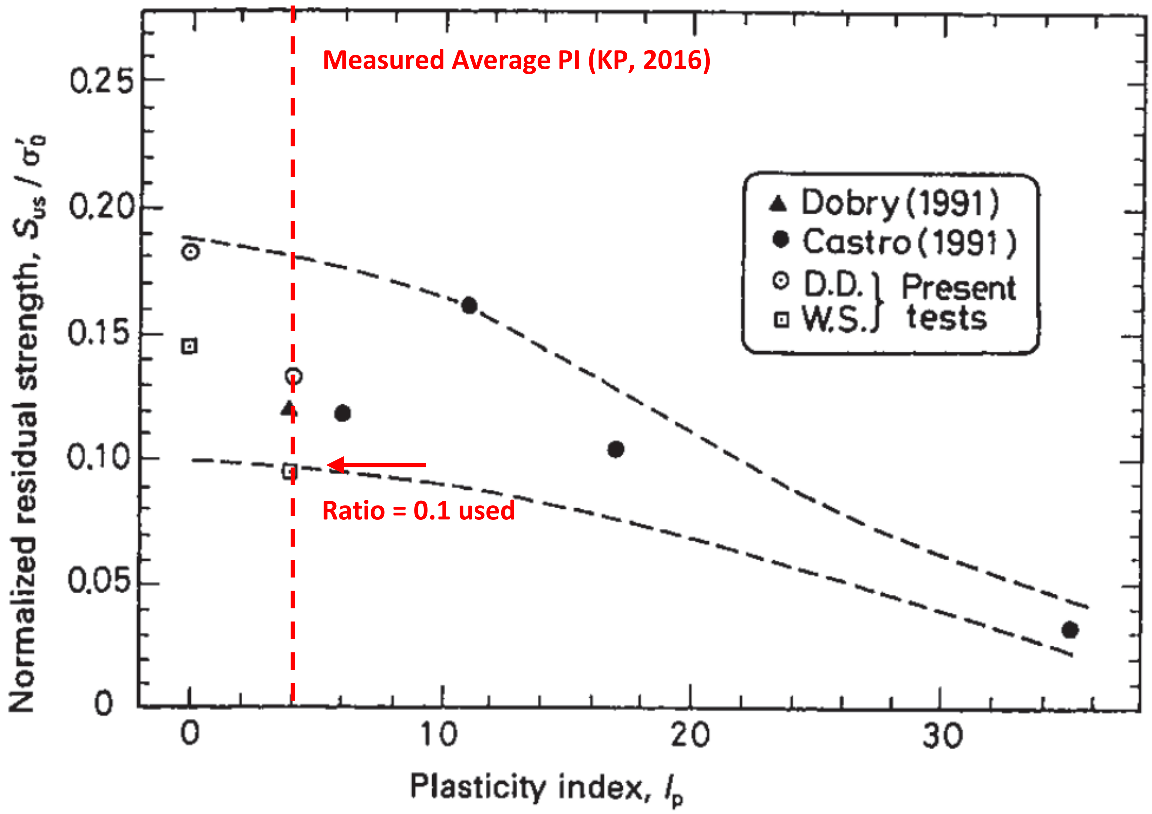


Fig. 11.24 Normalized residual strength plotted against plasticity index.

Figure reproduced from Ishihara (1996), Soil Behavior in Earthquake Geotechnics, Clarendon Press, Oxford, 1996.

Tailings Post-Liquefaction Strength:

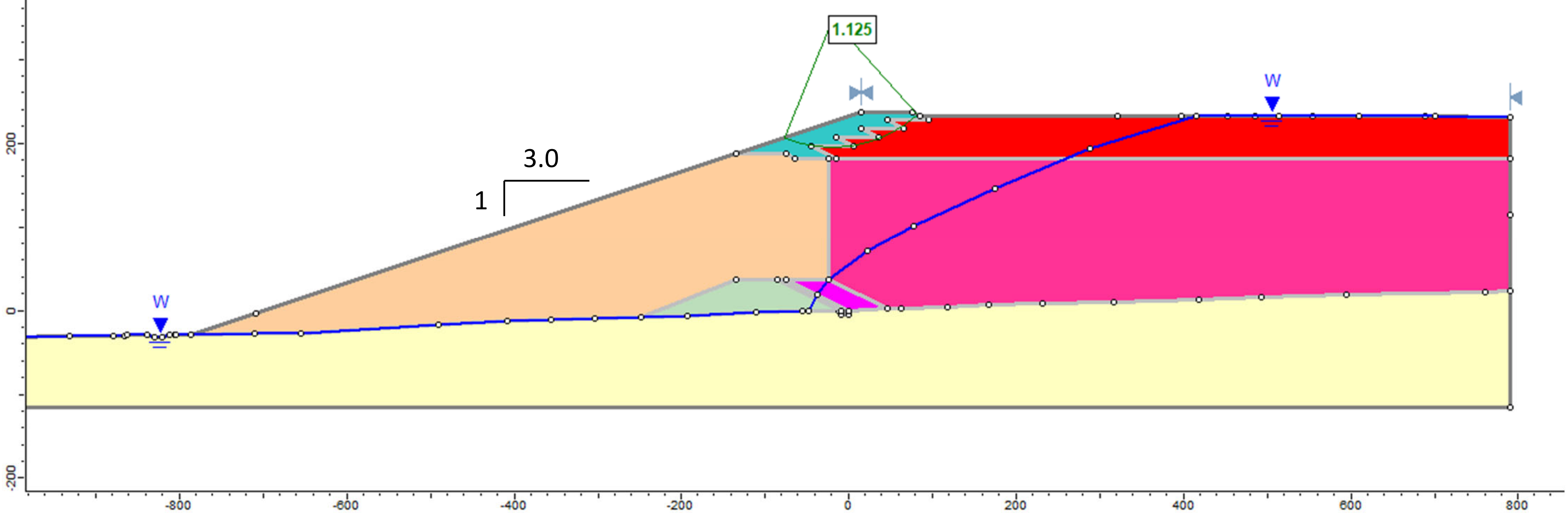
- **Average PI = 4 (based on testing data of KP, 2016; Figure 4-2)**
- **Post-liquefaction strength/effective overburden stress ratio = 0.10**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Tailings Post-Liquefaction Shear Strength

wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-50		
	PROJECT NUMBER: 17-2021-4024		
	SCALE: N/A	DATE: DEC 2021	

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Post-Liq)		100	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Post-Liq)		110	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Coarse Tailings (Post-Liq)		120	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1



Section TSF-1A Final Configuration

- **Post-Liquefaction Conditions**
- **Refer to Figure 4-50 for post-liquefaction strength**
- **Min. FOS = 1.13**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-1A Final – Post-Liquefaction Conditions

wood.

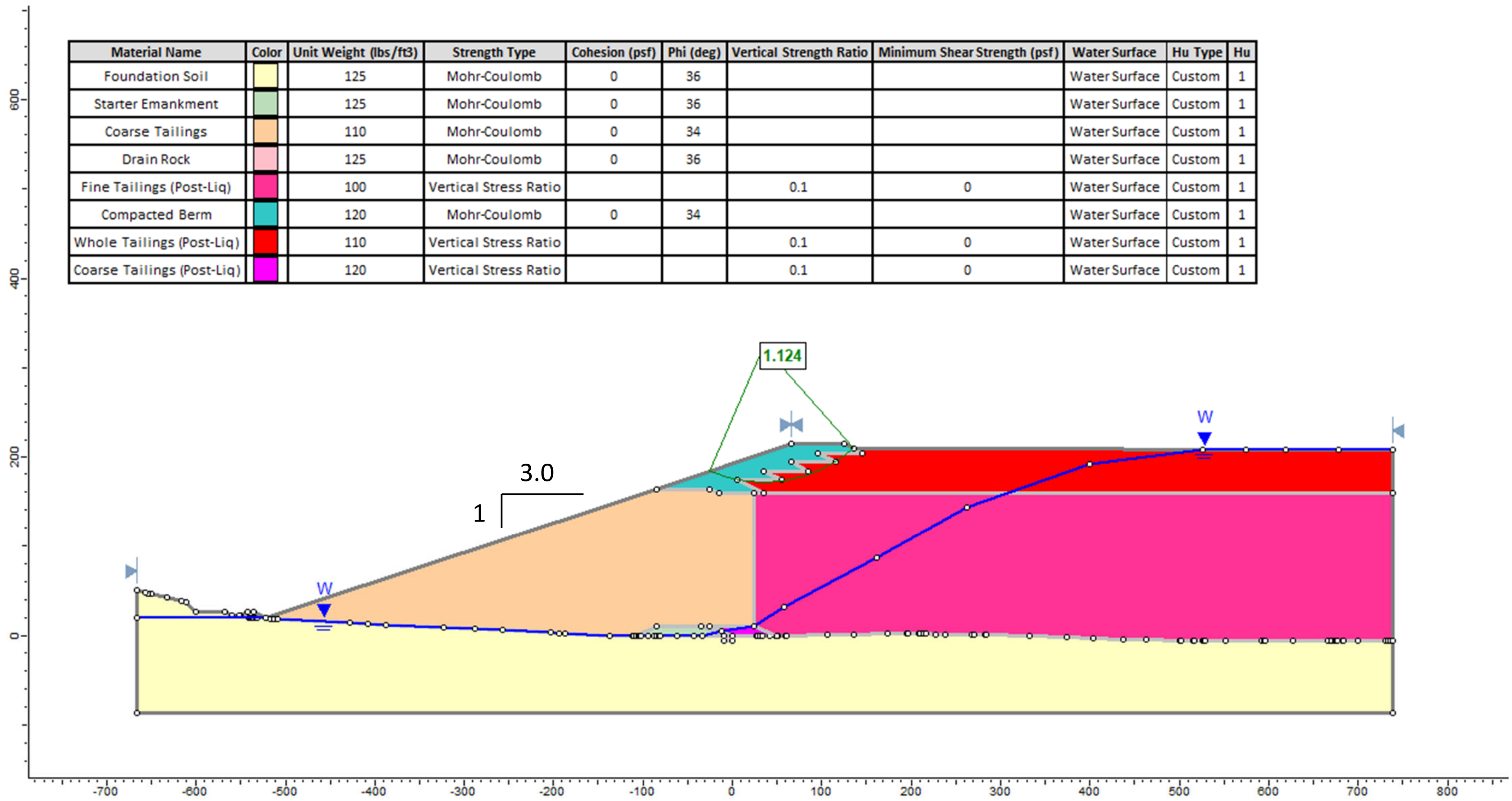
Wood Environment & Infrastructure Solutions, Inc.

Figure 4-51

PROJECT NUMBER: 17-2021-4024

SCALE: N/A DATE: DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Post-Liq)		100	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Post-Liq)		110	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Coarse Tailings (Post-Liq)		120	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1



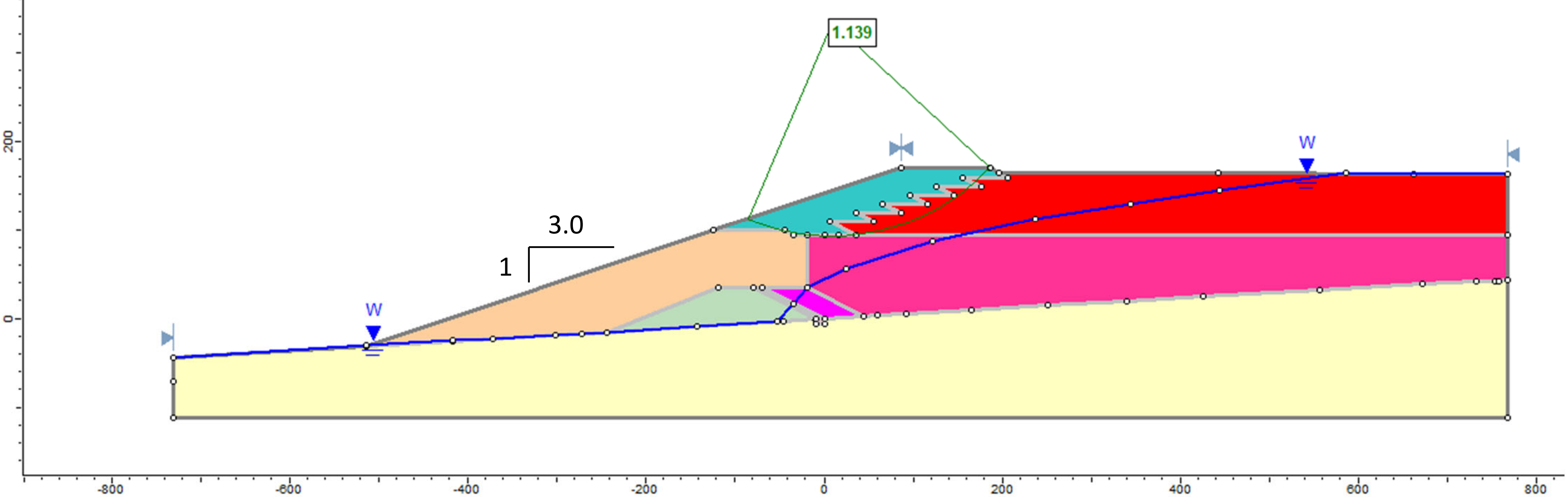
Section TSF-1B Final Configuration

- **Post-Liquefaction Conditions**
- **Refer to Figure 4-50 for post-liquefaction strength**
- **Min. FOS = 1.12**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-1B Final – Post-Liquefaction Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-52 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

RCC-CW003881

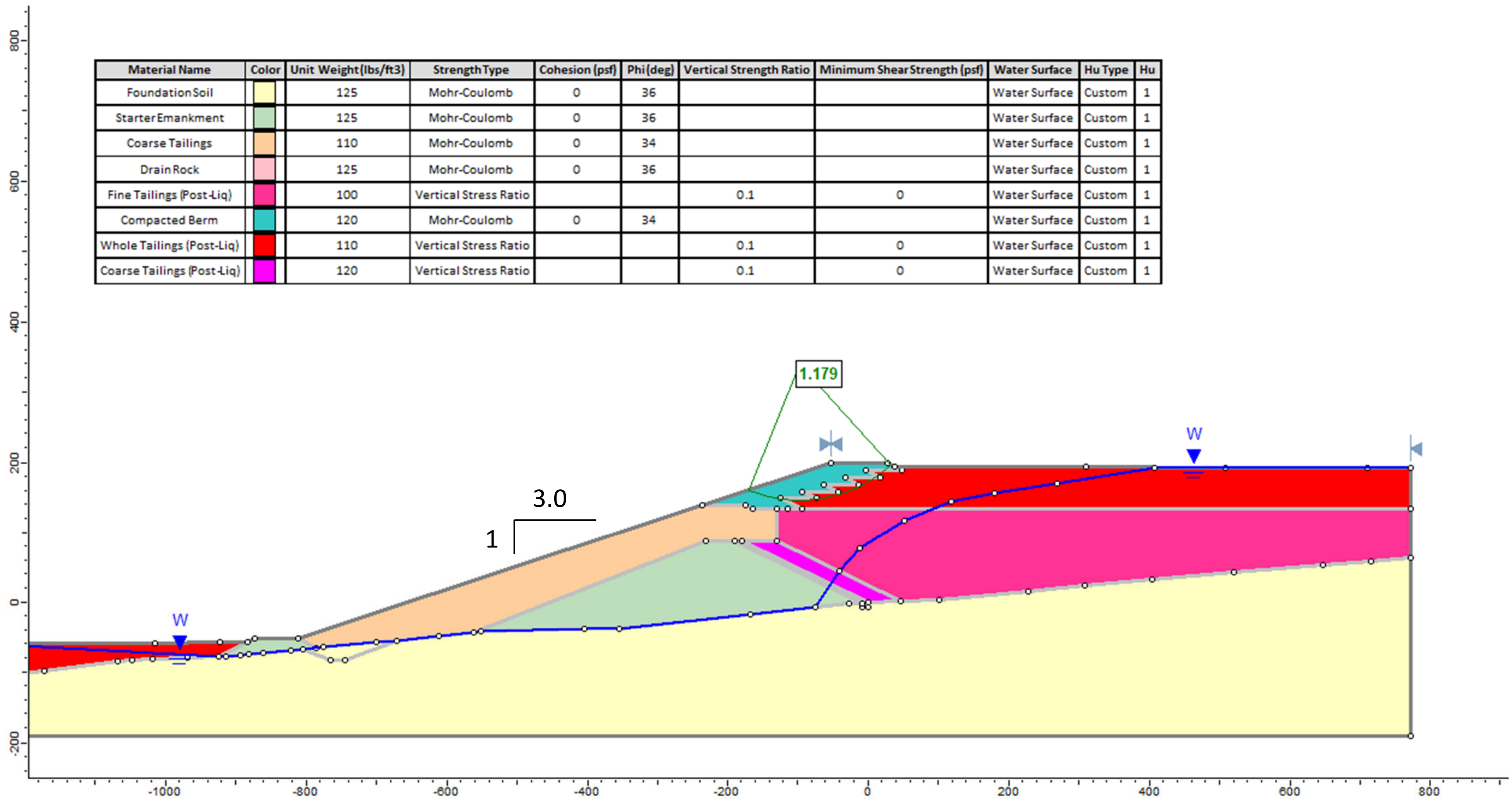
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Post-Liq)		100	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1



Section TSF-2A1 Final Configuration

- **Post-Liquefaction Conditions**
- **Refer to Figure 4-50 for post-liquefaction strength**
- **Min. FOS = 1.14**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-2A1 Final – Post-Liquefaction Conditions	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-53 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Post-Liq)		100	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Post-Liq)		110	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Coarse Tailings (Post-Liq)		120	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1

Section TSF-2A2 Final Configuration

- **Post-Liquefaction Conditions**
- **Refer to Figure 4-50 for post-liquefaction strength**
- **Min. FOS = 1.18**

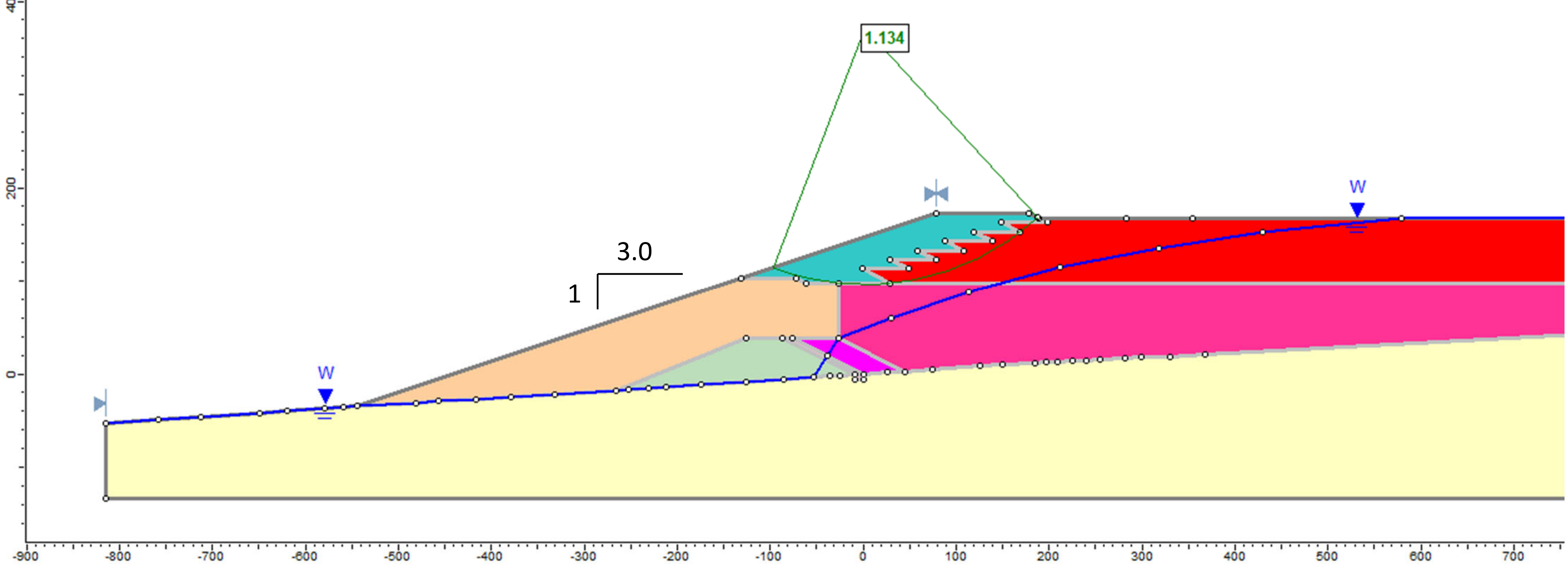
Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2A2 Final – Post-Liquefaction Conditions

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-54			
PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Post-Liq)		100	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Post-Liq)		110	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1
Coarse Tailings (Post-Liq)		120	Vertical Stress Ratio			0.1	0	Water Surface	Custom	1



Section TSF-2B Final Configuration

- **Post-Liquefaction Conditions**
- **Refer to Figure 4-50 for post-liquefaction strength**
- **Min. FOS = 1.13**

Rosemont Copper Company

Rosemont Copper World Project
PFS Design – TSF's
Stability Analyses

Section TSF-2B Final – Post-Liquefaction Conditions

wood.

Wood Environment & Infrastructure Solutions, Inc.

Figure 4-55

PROJECT NUMBER: 17-2021-4024

SCALE: N/A

DATE: DEC 2021

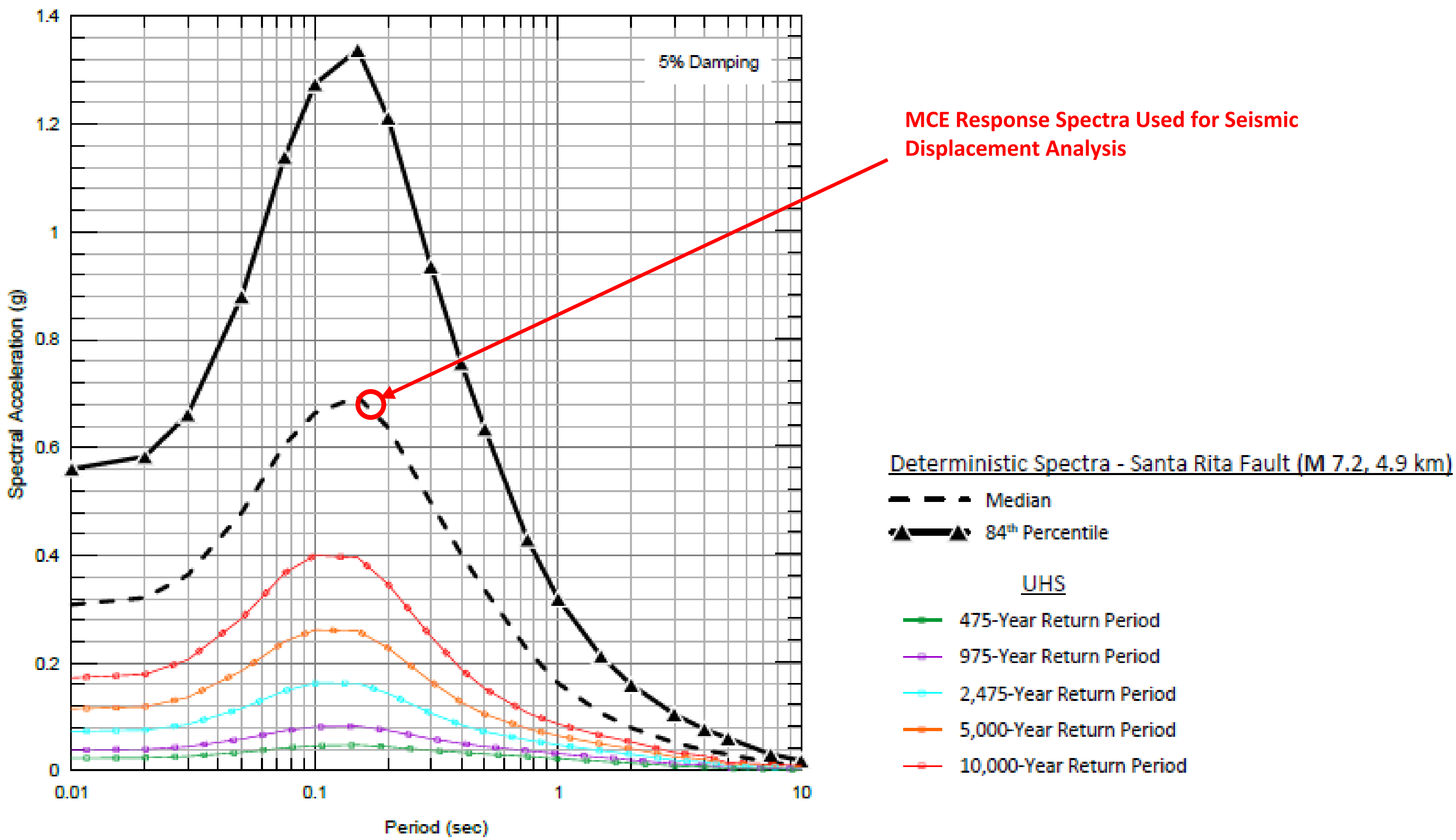
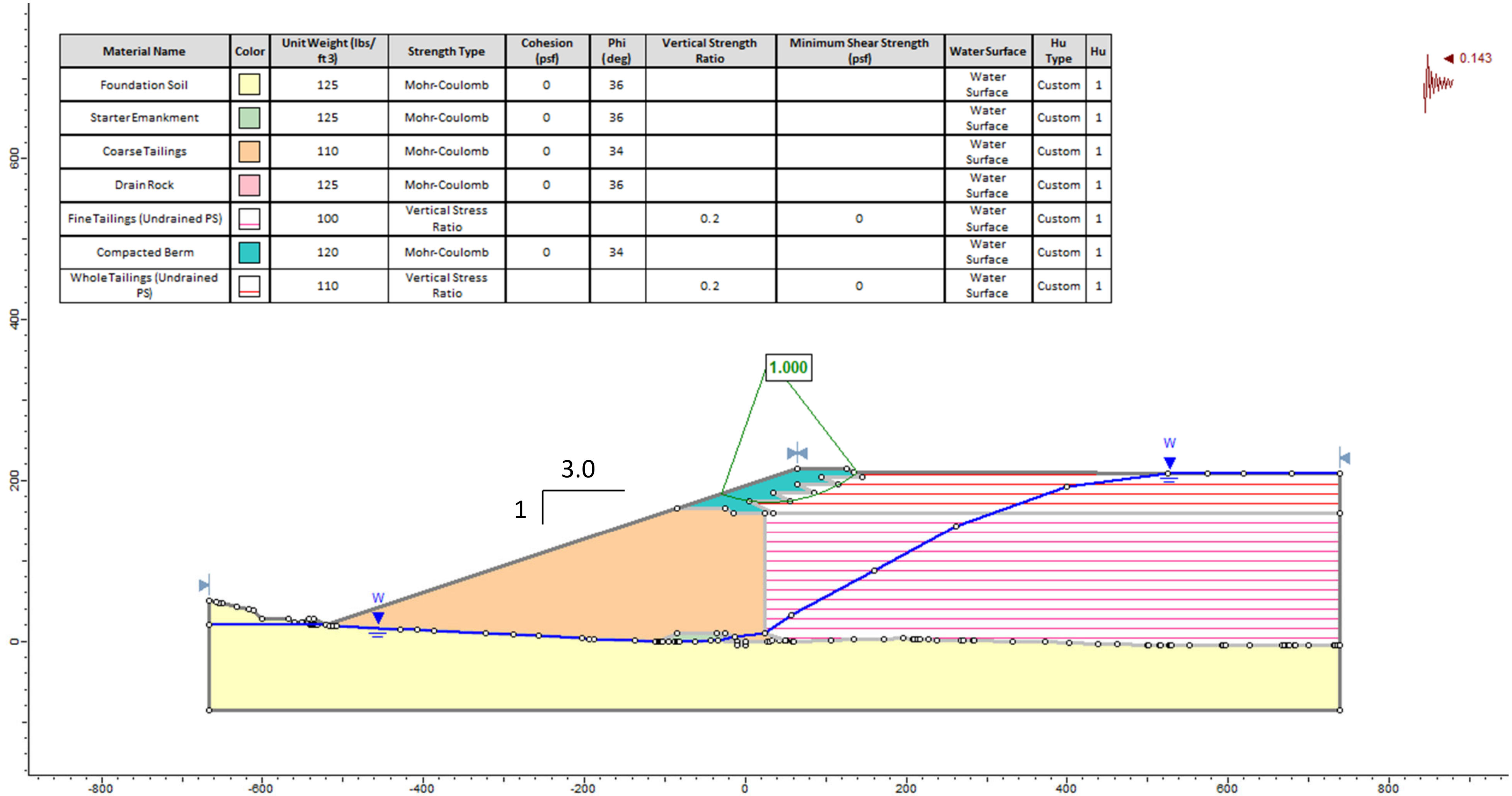


Figure reproduced from Figure 31, LCI (2021)

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
MCE Response Spectra Used for Seismic Displacement Analysis	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-56 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021

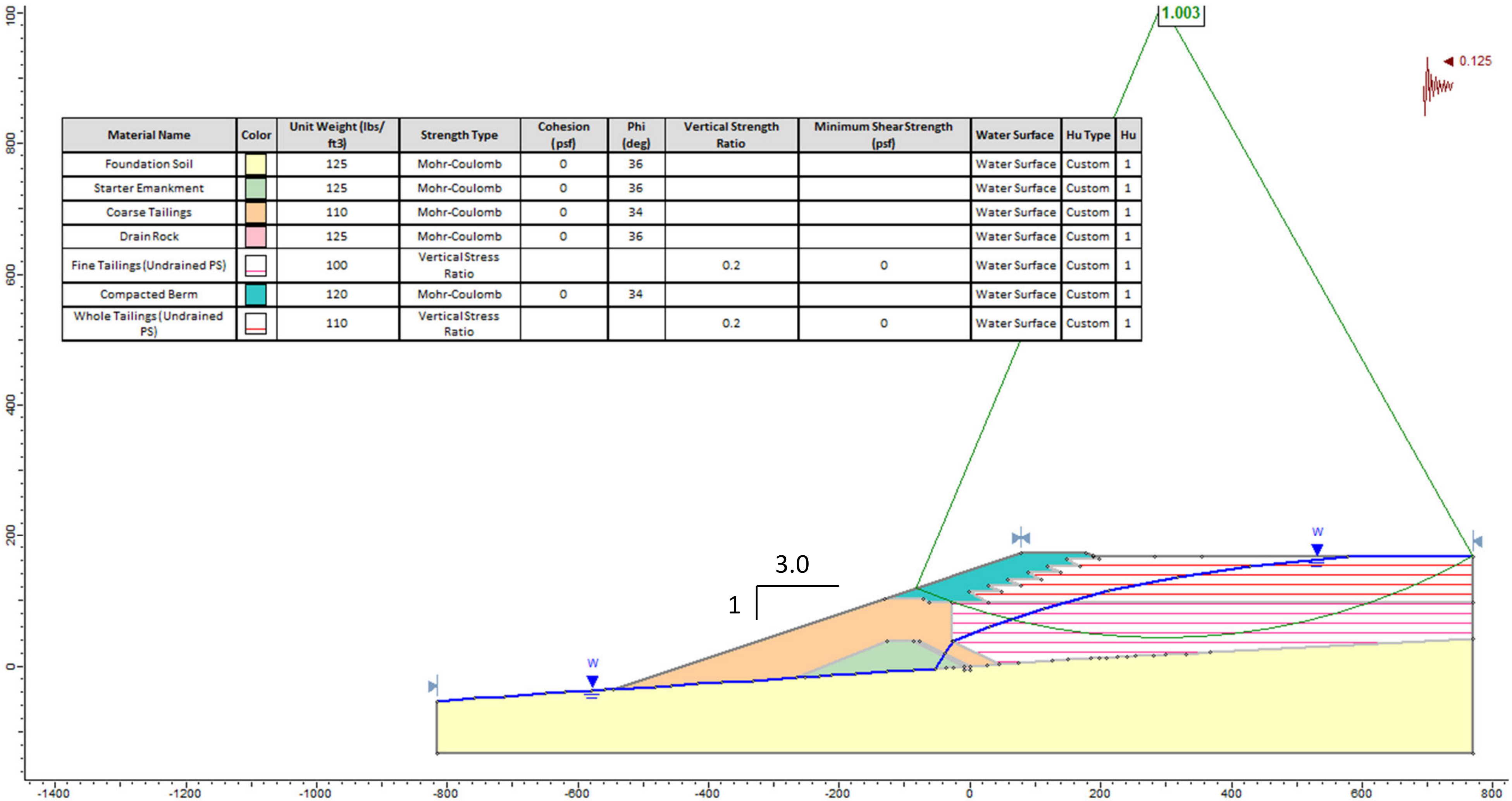
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1



Section TSF-1B Final Configuration

- **Yield Acceleration = 0.143g**
- **Min. FOS = 1.0**
- **To support Seismic Displacement Analysis**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses
Section TSF-1B Final – Yield Acceleration	
wood. **Wood Environment & Infrastructure Solutions, Inc.**	Figure 4-57 PROJECT NUMBER: 17-2021-4024 SCALE: N/A DATE: DEC 2021



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Vertical Strength Ratio	Minimum Shear Strength (psf)	Water Surface	Hu Type	Hu
Foundation Soil		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Starter Emankment		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Coarse Tailings		110	Mohr-Coulomb	0	34			Water Surface	Custom	1
Drain Rock		125	Mohr-Coulomb	0	36			Water Surface	Custom	1
Fine Tailings (Undrained PS)		100	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1
Compacted Berm		120	Mohr-Coulomb	0	34			Water Surface	Custom	1
Whole Tailings (Undrained PS)		110	Vertical Stress Ratio			0.2	0	Water Surface	Custom	1

Section TSF-2B Final Configuration

- **Yield Acceleration = 0.125g**
- **Min. FOS = 1.0**
- **To support Seismic Displacement Analysis**

Rosemont Copper Company	Rosemont Copper World Project PFS Design – TSF's Stability Analyses

Section TSF-2B Final – Yield Acceleration

wood. **Wood Environment & Infrastructure Solutions, Inc.**

Figure 4-58			
PROJECT NUMBER:	17-2021-4024		
SCALE:	N/A	DATE:	DEC 2021